TO: Mr. Ed Kianka

FROM: Professional Services

The attached is for your information.

Professionals in Chemistry

1985–1986

A Digest of Information about The Chemical Profession

OFFICE OF STATISTICAL SERVICES
AMERICAN CHEMICAL SOCIETY
WASHINGTON, D.C.

PROFESSIONALS IN CHEMISTRY: 1985-1986

A Digest of Information about
The Chemical Profession

Office of Statistical Services
American Chemical Society
1155 16th Street, N.W.
Washington, D.C. 20036

August, 1987

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INTRODUCTION

Professionals In Chemistry 1985-1986, the ninth edition of Professionals In Chemistry, follows the tradition of giving a profile of the chemical profession through statistical data. This edition is presented in six chapters: (1) Educational Pipeline (2) Characteristics of the Chemical Profession (3) Demography of Women and Minorities (4) Salaries and Employment Status (5) Supply and Demand and (6) Research and Development Expenditures.

Although there are fewer 18-year-olds graduating from high school, a higher percentage are enrolling in colleges. The first chapter follows them through the educational pipeline, and presents statistics about what new graduates do after completing work for a bachelor's, master's or doctoral degree in chemistry or chemical engineering.

The second chapter, which highlights experienced chemists and chemical engineers, focuses on doctorates. The emphasis is placed on doctorates because more detailed information is available on doctorates than any other degree level scientists and engineers. This chapter, specifically, presents such characteristics as employer types, work activity, sex, race, geographic distribution, and marital status of doctoral chemists. Additionally, this chapter gives information on salaries of all degree levels.

Chapter Three examines changes in the composition of the profession. While the number of doctorate recipients has leveled off, the characteristics of new doctorates have been changing. An area once dominated by white men is now giving way to women and minorities. This changing composition is of particular note because the new breed of doctorates now on the horizon will guide the profession into the new century.

Chapter Four, which is in two parts, describes the salaries and the employment status of groups of chemists and chemical engineers. Part A details the post-graduation status of recent degree recipients, while Part B concentrates on experienced professionals. Both parts rely on findings from recent surveys conducted by the ACS Office of Statistical Services.

Chapter Five is on supply and demand of scientists and engineers. The projection of how many jobs will be available in business and industry is important to colleges and technical schools, and to the young people who may become tomorrow's scientists, engineers and technicians. Although there seems to be no foolproof method of predicting the supply and demand of the science and engineering (S/E) manpower pool, some aggregate estimates are necessary.

Chapter Six takes the view that R&D expenditures are one of the two major factors that determine supply and demand for scientists and engineers, the other factor is the general economic conditions in the United States. This chapter, which relies largely on data from the National Science Foundation, examines funds available from the federal government, from universities, and from industry.

ACKNOWLEDGMENTS

In 1974 the American Chemical Society responded to requests for a statistical profile (periodically updated) of the chemical profession by introducing Professionals in Chemistry. The present volume is the ninth in a continuous series. This edition was prepared by Dr. Herman A. Young of the Office of Statistical Services, managed by John Robert Jones. Technical assistance was provided by Nguyen Bailey. We express appreciation for permission to use the sections written by Dr. Joan S. Burrelli, Office of Statistical Services, Dr. Nina M. Roscher, American University, and Mrs. Betty M. Vetter of the Commission on Professionals in Science and Technology (formerly Scientific Manpower Commission). Also gratefully acknowledged is assistance provided by Dr. Robert Dauffenbach of Oklahoma State University and members of the Division of Science Resources of the National Science Foundation.

Robert K. Neuman, Head
Dept. of Professional Services

CHAPTER I

EDUCATIONAL PIPELINE

CHAPTER I - EDUCATIONAL PIPELINE

Summary of Findings

Because the young persons entering the scientific manpower pool differ from those retiring, the pool is changing. It is important to chart these changes and to know how many scientists and engineers there are in the United States. It is also important to have a handle on the educational pipeline from high school through college and graduate school.

The composition of this pool is changing because women, minorities, and immigrants are a much larger fraction of the new entrants than of those leaving the pool because of retirement, death, or field switching. The pool is also subject to the vicissitudes of a changing society, which is currently undergoing qualitative and quantitative adjustments because of the decreasing numbers of 18-year-old persons entering college and their preferences for vocational choices in or out of sciences.

The number of high school graduates who enter the pool of college entrants is decreasing because the number of 18-year-olds is on the decline and will continue to decline until the early 1990's according to projections by the Center for Educational Statistics (C.E.S). Although the number of 18-year-olds is decreasing, the number of college entrants is relatively constant because an increasing percentage of high school graduates are attending college. Data on Fall Enrollment in Colleges and Universities in 1985 by the C.E.S., reported the total enrollment in all institutions of higher education in 1985 was 12,247,055 persons. Of this total, 29% were men enrolled full-time, 28% were women enrolled full-time, 18% were men enrolled part-time, and 24% were women enrolled part-time.

The number of bachelor's degrees granted in chemistry has been on the increase since 1955-56 when it stood at 6,178 degrees. After a peak of 11,617 in 1969-1970, the number has tended to level off. Since 1950, women have more than doubled at the BS level, and have increased by 250% at the doctoral level. Minorities have increased in number in 4-year colleges, and particularly in 2-year institutions. A concurrent increase took place in the work place. Blacks, Hispanics, Mexican Americans, and Asians have been steadily increasing in the physical sciences and also in engineering.

Upon graduation, 74% of the BS graduates had definite plans as to what they intended to do. Women and minorities showed a greater disparity in graduation plans status than white males. Overall about 6% more men had definite plans than women.

Trend data on doctorates in all fields, in the publication Doctorate Recipients from United States Universities, Summary Report 1985, by National Research Council (N.R.C.), showed a decline over the past ten years. In 1976 there were 4,089 doctorates awarded to men in the physical sciences and 420 doctorates awarded to women. From 1976 to 1985 the total number of doctorates in all fields decreased from 32,946 to 31,201. In the physical sciences, however, there was a slight increase from 4,509 in 1976 to 4,531 in 1985. Doctoral recipients in chemistry have gone through fluctuating periods, but have been on the increase since 1978. In engineering, total enrollment increased slightly, but women's enrollment quadrupled from 54 in 1976 to 198 in 1985.

On ethnicity of doctorate recipients, racial and ethnic minority groups have increased. American Indians have increased from 0.1% in 1975 to 0.4% in 1985. Asians have increased from 1.1% in 1975 to 2.3% in 1985. Blacks had only modest increases from 3.8% in 1975 to 4.0% in 1985. Hispanics increased from 1.2% to 2.5% over the same time period. Whites decreased in percentages from 93.7% to 90.9% by 1985. Asian women have increased more in the physical sciences and engineering while black women have increased more in education and professional fields.

In the work place, chemists and chemical engineers are employed in all areas of critical national interest. Industry, educational institutions, and government are areas of national interest that experienced the greatest percentage increases.

Characteristics of College Students, Age 18-34 Years

Selected characteristics of college students in the U.S. from the C.E.S. showed most enrolled in business and commerce, with engineering second. Students between the ages of 18 and 19 years were the largest group with 20- and 21-year olds being second. Fifty-one percent were males, and 49% were females. Eighty five percent were white, and Blacks were second with 10.2%. Most students were not married.

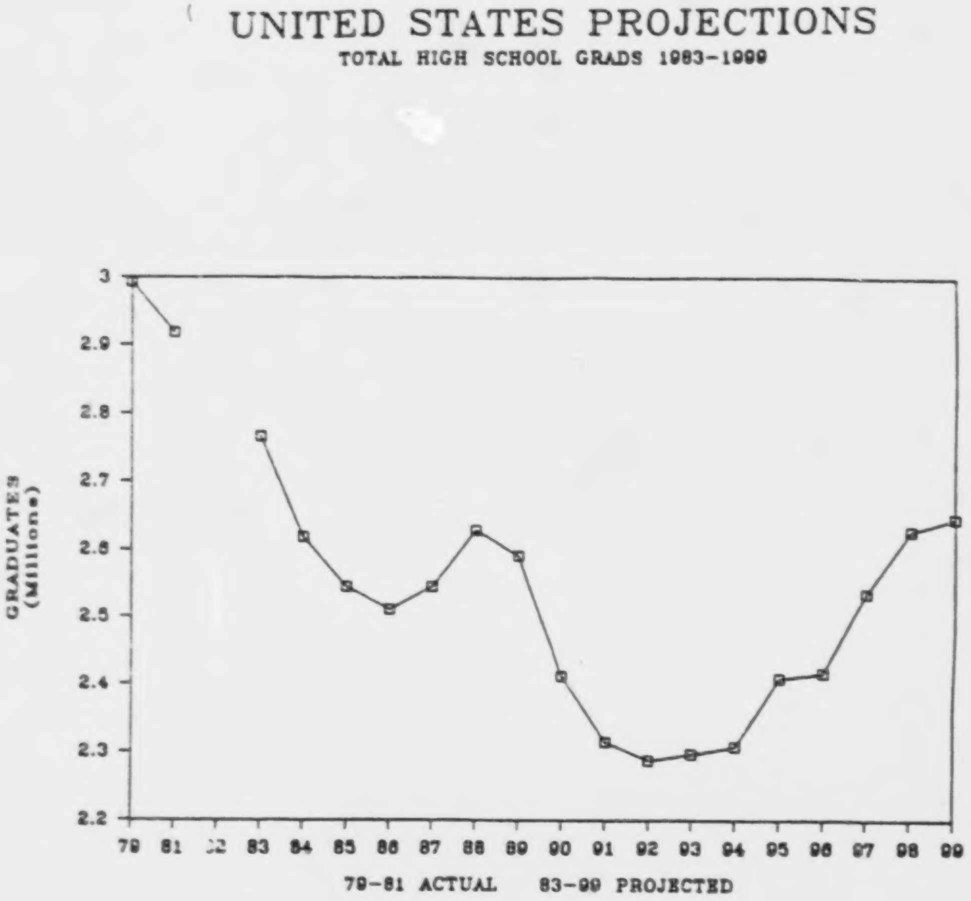
The residences of most college students were in suburbia, 45% and next were the residences of those that lived in the city (31%).

Most students (27%) were in their first year of college, and the next group (24%) were in their second year of college.

The changing population of 4-year-colleges is affected by the influx of transfer students from 2-year post-secondary institutions. This influx replaces the attrition of first-time enrollees who drop out of the 4-year institutions.

In this overview of the educational scenario of the chemists and chemical engineers, we have given a quantitative description of the American educational scene. The qualitative assessment, however, is more difficult to ascertain when one compares the U.S. educational system with that of its world technological competitors. In summation, as long as the American people continue to show a high regard for learning, the U.S. educational process will remain healthy.

Figure I.1.a



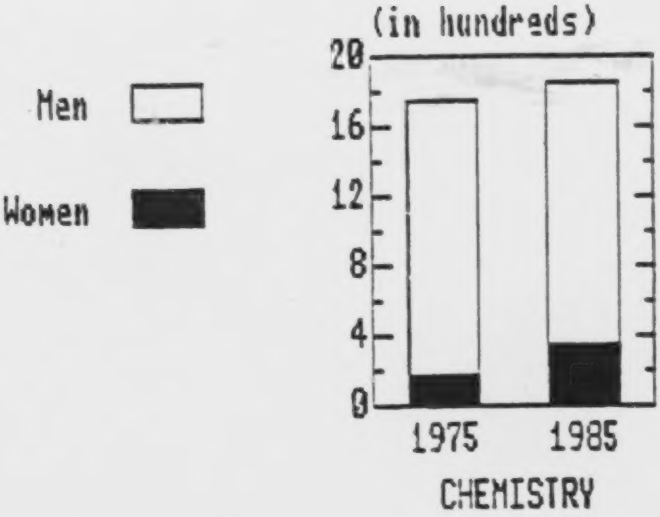
UNITED STATES PROJECTIONS
TOTAL HIGH SCHOOL GRADS 1983-1999

Source: High School Graduates: Projections for the Fifty States (1982-2000), Western Interstate Commission for Higher Education.

Table 1.1

DOCTORATE RECIPIENTS IN CHEMISTRY: 1975-85

Field	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Sciences, total	15,356	15,030	14,775	14,625	14,755	14,720	15,105	14,980	15,151	15,154	15,275
Men	12,572	12,103	11,742	11,365	11,234	11,009	11,181	10,961	10,807	10,738	10,788
Women	2,784	2,927	3,033	3,260	3,521	3,711	3,924	4,019	4,344	4,416	4,487
Chemistry	1,776	1,624	1,571	1,544	1,566	1,538	1,612	1,680	1,759	1,765	1,836
Men	1,582	1,435	1,391	1,349	1,347	1,283	1,376	1,407	1,462	1,445	1,474
Women	194	189	180	195	219	255	236	273	297	320	362



Source: NSF Unpublished Data

Table 1.2

Total Enrollment in Institutions of Higher Education, by Level of Enrollment and by State:
1985

State or Other Area	Total Enrollment	Level of Enrollment				
					Unclassified	
		Under-graduate	First-Prof.	Graduate	Below the Baccalaureate	Post-Baccalaureate
United States	12,247,055	9,414,074	274,200	1,129,538	1,182,600	246,643
Alabama	179,343	155,096	3,019	14,218	5,389	1,621
Alaska	27,479	11,765	---	1,190	13,894	630
Arizona	216,854	179,075	1,390	16,557	13,730	6,102
Arkansas	77,958	65,551	1,422	6,503	3,591	891
California	1,650,439	1,258,019	31,153	119,415	206,144	35,708
Colorado	161,314	119,737	3,112	14,804	19,244	4,417
Connecticut	159,348	117,289	3,326	25,524	9,628	3,581
Delaware	31,883	25,459	---	2,347	3,959	118
District of Columbia	78,868	44,022	8,859	19,340	3,105	3,542
Florida	451,392	349,090	6,991	33,467	52,403	9,441
Georgia	196,826	154,971	7,694	21,439	9,809	2,913
Hawaii	49,937	39,450	496	4,011	4,601	1,379
Idaho	42,668	35,623	249	4,145	1,777	874
Illinois	678,689	482,201	17,362	62,612	104,986	11,528
Indiana	250,567	205,926	5,735	24,933	9,417	4,556
Iowa	152,897	126,044	5,753	15,369	5,195	536
Kansas	141,859	107,363	2,348	13,946	11,841	5,861
Kentucky	141,724	109,576	4,596	11,655	11,900	3,997
Louisiana	177,176	140,909	4,974	17,427	9,305	4,561
Maine	52,201	34,172	569	2,094	15,230	136
Maryland	231,649	184,719	3,322	24,508	15,273	3,827
Massachusetts	421,175	282,368	13,245	55,552	59,069	10,941
Michigan	507,293	424,890	10,093	41,789	22,544	7,977
Minnesota	221,162	181,734	6,099	16,598	12,536	4,195
Mississippi	101,180	88,785	1,771	7,262	1,795	1,567
Missouri	241,146	176,687	9,077	25,633	26,531	3,218
Montana	35,958	30,602	217	2,054	1,358	1,667
Nebraska	97,769	75,381	2,740	9,604	9,347	697
Nevada	43,656	36,526	259	1,646	4,324	901
New Hampshire	52,283	39,603	638	4,737	6,088	1,217

Table 1.2 (Cont'd)

State or Other Area	Total Enrollment	Under-graduate	First-Prof.	Graduate	Below the Baccalau-reate	Post-Baccalau-reate
United States	12.247.055	9.414.074	274.200	1.129.538	1.182.600	246.643
New Jersey	297,658	222,512	5,764	31,008	30,831	7,543
New Mexico	68,295	46,319	618	7,109	13,697	552
New York	1,000,098	714,337	24,832	120,507	111,967	28,455
North Carolina	327,288	244,968	5,934	20,970	81,211	4,205
North Dakota	37,939	32,242	441	2,061	1,983	1,212
Ohio	514,745	421,390	13,144	49,398	24,798	6,015
Oklahoma	169,173	125,833	4,139	16,461	8,267	4,413
Oregon	137,967	107,371	3,240	9,987	14,043	3,326
Pennsylvania	933,198	413,906	15,049	59,704	38,891	5,508
Rhode Island	69,927	50,522	448	5,842	11,223	1,892
South Carolina	131,902	107,003	2,615	10,872	8,087	3,265
South Dakota	32,772	26,183	464	2,634	2,873	618
Tennessee	194,845	154,508	5,525	14,220	15,382	5,210
Texas	769,092	617,234	18,598	77,515	42,038	14,307
Utah	103,994	93,156	1,203	7,360	796	1,479
Vermont	31,416	23,226	731	2,113	4,977	369
Virginia	292,416	197,884	5,911	23,913	57,575	7,133
Washington	231,553	191,266	3,248	14,625	17,649	4,765
West Virginia	76,059	61,336	1,256	8,259	4,847	961
Wisconsin	275,069	210,982	3,694	20,639	33,585	6,169
Wyoming	24,204	18,314	201	1,295	3,867	527
U.S. Service Schools	54,052	50,749	636	2,667	---	---
Outlying areas	164.890	146.529	3,131	8,527	6,549	154
American Samoa	758	758	---	---	---	---
Guam	4,601	3,247	---	330	1,024	---
Northern Marianas	318	215	---	---	103	---
Puerto Rico	155,917	140,936	3,131	8,016	3,680	154
Trust Terriotory of the Pacific	724	697	---	---	27	---
Virgin Islands	2,572	676	---	181	1,715	---

Source: U.S. Department of Education, Center for Statistics, "Fall Enrollment in Colleges and Universities, 1985" survey (July 1986).

Table 1.3

TRENDS OF CHEMISTRY DEGREES GRANTED FROM 1956-1985

Academic Year	Bachelor's	Master's	Ph.D.
1955-56	6,178	1,164	986
1956-57	6,591	1,047	1,003
1957-58	7,010	1,125	939
1958-59	7,308	1,145	1,009
1959-60	7,603	1,228	1,048
1960-61	7,604	1,313	1,131
1961-62	8,089	1,425	1,139
1962-63	8,823	1,463	1,254
1963-64	9,724	1,586	1,301
1964-65	10,047	1,715	1,414
1965-66	9,735	1,839	1,571
1966-67	9,872	1,831	1,744
1967-68	10,847	2,014	1,757
1968-69	11,807	2,070	1,941
1969-70	11,617	2,146	2,208
1970-71	11,183	2,284	2,160
1971-72	10,721	2,259	1,971
1972-73	10,226	2,230	1,882
1973-74	10,525	2,138	1,828
1974-75	10,649	2,006	1,824
1975-76	11,107	1,796	1,623
1976-77	11,322	1,775	1,571
1977-78	11,474	1,892	1,525
1978-79	11,643	1,765	1,518
1979-80	11,232	1,723	1,545
1980-81	11,347	1,654	1,622
1981-82	11,062	1,742	1,708
1982-83	11,261	1,739	1,705
1983-84	10,704	1,667	1,744
1984-85	10,195	1,598	1,631

Source: Center for Education Statistics, Earned Degree Conferred series, unpublished data 1986.

Table 1.4

Number of Degrees by Level: Selected Years

Year	Bachelor's and first-professional			Master's			Doctorates		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
1950	10,619	9,134	1,485	1,576	1,368	208	953	914	39
1960	7,603	6,005	1,598	1,228	1,025	203	1,048	1,000	48
1970	11,617	9,501	2,116	2,146	1,666	480	2,208	2,039	169
1980	11,446	8,169	3,277	1,733	1,286	447	1,551	1,291	260
1981	11,540	8,065	3,475	1,667	1,194	473	1,626	1,373	253
1982	11,316	7,703	3,613	1,758	1,261	497	1,726	1,442	284
1983	11,039	7,303	3,736	1,632	1,167	465	1,747	1,451	296
1984	10,704	6,973	3,731	1,667	1,137	530	1,744	1,425	319
1985	10,195	6,505	3,690	1,598	1,081	518	1,631	1,311	320

Sources: National Science Foundation and Center for Education Statistics, Department of Education.

Table 1.5

PhD CHEMISTRY GRADUATES
according to EMPLOYMENT STATUS, ETHNICITY
1986 Starting Salaries Survey

EMPLOYMENT STATUS	WHITE	BLACK	HISPANIC	AMER INDIAN	ASIAN	OTHER
Full-time in chemistry	51	0	1	0	6	0
Row Percent	87.9%	0.0%	1.7%	0.0%	10.3%	0.0%
Column Percent	50.0%	0.0%	100.0%	0.0%	37.5%	0.0%
Full-time in non-chemistry	3	0	0	0	0	0
Row Percent	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Column Percent	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%
Fellowship	46	0	0	0	9	1
Row Percent	82.1%	0.0%	0.0%	0.0%	16.1%	1.8%
Column Percent	45.1%	0.0%	0.0%	0.0%	56.3%	100.0%
Seeking employment	2	0	0	0	1	0
Row Percent	66.7%	0.0%	0.0%	0.0%	33.3%	0.0%
Column Percent	2.0%	0.0%	0.0%	0.0%	6.3%	0.0%
Not seeking employment	0	0	0	0	0	0
Row Percent	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Column Percent	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL	102	0	1	0	16	1
Row Percent	85.0%	0.0%	.8%	0.0%	13.3%	.8%
Column Percent	100.0%	0.0%	100.0%	0.0%	100.0%	100.0%

Source: ACS Starting Salaries of Chemists and Chemical Engineers, 1986

Table 1.6

PhD CHEMICAL ENGINEERING GRADUATES according to EMPLOYMENT STATUS, ETHNICITY 1986 Starting Salaries Survey

EMPLOYMENT STATUS	WHITE	BLACK	HISPANIC	ASIAN	OTHER
Full-time in chemistry	56	2	4	11	0
Row Percent	76.7%	2.7%	5.5%	15.1%	0.0%
Column Percent	87.5%	100.0%	66.7%	50.0%	0.0%
Full-time in non-chemistry	4	0	1	1	0
Row Percent	66.7%	0.0%	16.7%	16.7%	0.0%
Column Percent	6.3%	0.0%	16.7%	4.5%	0.0%
Fellowship	2	0	1	9	0
Row Percent	16.7%	0.0%	8.3%	75.0%	0.0%
Column Percent	3.1%	0.0%	16.7%	40.9%	0.0%
Seeking employment	1	0	0	1	0
Row Percent	50.0%	0.0%	0.0%	50.0%	0.0%
Column Percent	1.6%	0.0%	0.0%	4.5%	0.0%
• Not seeking employment	1	0	0	0	0
Row Percent	100.0%	0.0%	0.0%	0.0%	0.0%
Column Percent	1.6%	0.0%	0.0%	0.0%	0.0%
TOTAL	64	2	6	22	0
Row Percent	68.1%	2.1%	6.4%	23.4%	0.0%
Column Percent	100.0%	100.0%	100.0%	100.0%	0.0%

Source: ACS Starting Salaries of Chemists and Chemical Engineers, 1986

Table 1.7

Doctorates Awarded by U.S. Universities according to Sex: 1976 - 1985

	Year of Doctorate									
Field	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Total All Fields										
Men	25262	23858	22553	22300	21610	21461	21006	20718	20599	20502
Women	7684	7858	8322	8937	9407	9892	10091	10498	10678	10699
Physical Sciences										
Men	4089	3949	3754	3803	3609	3667	3715	3809	3795	3817
Women	420	430	439	496	502	503	576	617	657	714
Engineering										
Men	2780	2569	2370	2428	2389	2429	2522	2657	2762	2967
Women	54	74	53	62	90	99	124	124	151	198

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

Table 1.8

Race/Ethnicity of Doctorate Recipients, 1975-1985 (U.S. Citizens)

	Year of Doctorate										
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Total Reporting Race/Ethnicity	25976	26182	25008	23767	23947	23970	24006	23785	23704	23394	22717
American Indian	36 0.1*	40 0.2	65 0.3	60 0.3	81 0.3	75 0.3	85 0.4	77 0.3	80 0.3	73 0.3	93 0.4
Asian	286 1.1	334 1.3	339 1.4	390 1.6	428 1.8	458 1.9	465 1.9	452 1.9	492 2.1	512 2.2	515 2.3
Black	999 3.8	1095 4.2	1116 4.5	1033 4.3	1056 4.4	1032 4.3	1013 4.2	1047 4.4	921 3.9	953 4.1	909 4.0
Hispanic	303 1.2	340 1.3	423 1.7	473 2.0	462 1.9	412 1.7	464 1.9	535 2.2	538 2.3	535 2.3	559 2.5
White	24352 93.7	24373 93.1	23065 92.2	21811 91.8	21920 91.5	21993 91.8	21979 91.6	21674 91.1	21673 91.4	21321 91.1	20641 90.9

*Percent of total U.S. citizenship doctorate recipients reporting racial/ethnic status.

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

Table 1.9

Number of Doctorate Recipients in Chemistry and Chemical Engineering by Specialty: 1975 - 1985

	Year of Doctorate										
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Chemistry	1776	1624	1571	1544	1566	1538	1612	1680	1759	1765	1836
Analytical	142	152	174	178	207	185	229	190	264	228	285
Agricultural and Food	8	14	6	8	11	-	-	-	-	-	-
Inorganic	229	226	198	201	195	189	188	226	215	233	251
Nuclear	21	25	24	13	14	14	12	20	13	18	7
Organic	605	497	479	454	469	484	494	519	503	525	493
Pharmaceutical	66	55	50	51	43	52	52	55	78	56	60
Physical	393	355	339	310	326	282	275	324	311	329	304
Polymer	40	42	55	57	67	61	62	50	62	63	84
Theoretical	46	48	38	46	50	47	33	32	48	37	48
Chemistry, General	169	144	146	161	126	157	193	175	177	183	214
Chemistry, Other	57	66	62	65	58	67	74	89	88	93	90
Engineering	3002	2834	2643	2423	2490	2479	2528	2646	2781	2913	3165
Chemical	370	314	306	261	287	285	296	306	349	361	440

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

Table 1.10

Enrollment of persons 14 to 34 years of age in institutions of higher education, by major field of study: United States, October 1966, 1972, 1978, and 1982

Major field of study	1966		1972		1978		1982	
	Number (in thousands)	Percent	Number (in thousands)	Percent	Number (in thousands)	Percent	Number (in thousands)	Percent
1	2	3	4	5	6	7	8	9
All fields	**5,999**	**100.0**	**8,313**	**100.0**	**9,838**	**100.0**	**10,919**	**100.0**
Agriculture and forestry	73	1.2	97	1.2	[1]144	[1]1.5	[1]259	[1]2.4
Biological sciences	602	10.0	257	3.1	303	3.1	318	2.9
Health and medical profession			695	8.4	872	8.9	1,305	12.0
Business and commerce	888	14.8	1,157	13.9	1,956	19.9	2,586	23.7
Education	1,118	18.6	1,007	12.1	781	7.9	732	6.7
Engineering	534	8.9	357	4.3	565	5.7	[2]1,229	[2]11.3
English and journalism	620	10.3	291	3.5	192	2.0	304	2.8
Other humanities			455	5.5	741	7.5	852	7.8
Law	(3)	(3)	237	2.9	220	2.2	252	2.3
Mathematics and statistics	[2]236	[2]3.9	[2]239	[2]2.9	[2]142	[2]1.4	187	1.7
Physical sciences	226	3.8	157	1.9	193	2.0	258	2.4
Social sciences	642	10.7	954	11.5	763	7.8	763	7.0
Other fields or not reported	1,060	17.7	2,410	29.0	2,966	30.1	1,874	17.2

[1] Includes home economics.

[2] Includes computer sciences.

[3] Data not available.

NOTE.—Data are based upon sample surveys of the civilian noninstitutional population. Because of rounding, percents may not add to 100.0

SOURCES: U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P-20, No. 260; and *Statistical Abstract of the United States*, 1982–83 and 1985 editions.

Table 1.11

Selected characteristics of college students 14 to 34 years of age: United States, October 1983

Characteristic	Number (in thousands)	Percent
1	2	3
All students	10,825	100.00
Age:		
14 and 15 years	8	.1
16 and 17 years	252	2.3
18 and 19 years	2,940	27.2
20 and 21 years	2,495	23.0
22 to 24 years	2,042	18.9
25 to 29 years	1,921	17.7
30 to 34 years	1,167	10.8
Sex:		
Male	5,504	50.8
Female	5,321	49.2
Race:		
White	9,242	85.4
Black	1,102	10.2
Other	481	4.4
Marital status:		
Married, spouse present	1,932	17.8
Other	8,893	82.2
Residence:[1]		
Metropolitan area (in central cities)	3,396	31.4
Metropolitan area (outside central cities)	4,881	45.1
Nonmetropolitan area	2,547	23.5
Year of college:		
First	2,987	27.6
Second	2,624	24.2
Third	1,805	16.7
Fourth	1,595	14.7
Fifth	850	7.9
Sixth or higher	964	8.9

[1] Residence refers to the permanent home address of the student rather than to where he or she attends college.

NOTE.—Data are based upon a sample survey of the civilian noninstitutional population. Because of rounding, details may not add to totals.

SOURCE: U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P-20, No. 394; and unpublished data.

Table 1.12

Selected Characteristics of 1980 Terminal-Degree Graduates[1] and Postsecondary Education Participants:[2] United States,

Item	Total		Socioeconomic Status					
			Low		Middle		High	
	Terminal-Degree Graduates	Postsecondary Education Participants	Terminal-Degree Graduates	Postsecondary Education Participants	Terminal-Degree Graduates	Postsecondary Education Participants	Terminal-Degree Graduates	Postsecondary Education Participants
	Percentage Distribution							
Control of school:								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Public	95.2	87.0	96.2	93.2	94.7	88.7	87.8	81.0
Private	4.8	13.0	3.8	6.8	5.3	11.3	12.2	19.0
Sex:								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Male	52.7	46.2	46.0	39.3	54.5	44.4	66.4	51.0
Female	47.3	53.8	54.0	60.7	45.5	55.6	33.6	49.0
Race/ethnicity:								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
White and other[3] non-Hispanic	77.7	81.2	63.3	57.0	84.9	83.9	88.8	92.1
Black, non-Hispanic	10.7	11.2	17.9	26.1	7.2	8.6	6.2	4.1
Hispanic	11.6	7.6	18.8	16.9	7.9	7.5	5.0	3.8
High school program:								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Academic	12.0	44.2	9.9	33.5	12.9	48.4	36.9	65.1
General	56.0	40.9	48.4	40.3	48.4	33.4	43.3	25.6
Vocational	32.0	14.9	41.7	26.2	38.7	18.2	19.8	9.3
	Number							
Self-reported average number of years taken during high school in:								
English	2.9	3.0	2.9	3.0	2.9	3.0	2.9	3.0
Mathematics	1.7	2.2	1.5	2.0	1.6	2.2	2.0	2.5
Science	1.4	1.9	1.3	1.7	1.4	1.9	1.7	2.2
Social studies	2.2	2.4	2.2	2.3	2.2	2.4	2.3	2.4
Foreign language	.5	1.1	.4	.8	.4	1.0	.7	1.4
Vocational education	2.8	2.2	2.6	2.5	3.1	2.3	2.4	1.8

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[1] Terminal-degree graduates participated in no postsecondary school between spring 1980 and spring 1982. Terminal-degree status was measured with the High School and Beyond item asking if respondents had enrolled in or taken classes at any school between the time of leaving high school and the end of February 1982. Those missing on this item were deleted, as were those who indicated that they had not graduated from high school.

[2] Postsecondary education participants enrolled in some type of postsecondary education between spring 1980 and spring 1982. They may or may not be currently enrolled.

[3] The "other" racial/ethnic classification includes Asian or Pacific Islander and American Indian/Alaskan Native.

SOURCE: U.S. Department of Education, National Center for Education Statistics, High School and Beyond Study, unpublished tabulations (August 1984).

CHAPTER II

CHARACTERISTICS OF DOCTORAL CHEMISTS AND CHEMICAL ENGINEERS

CHAPTER II - CHARACTERISTICS OF DOCTORAL CHEMISTS AND CHEMICAL ENGINEERS

Summary of Findings

Although chemists and chemical engineers are related in that their expertise is primarily in the discipline of chemistry, engineering deals more with systems of chemistry through processes, materials and products management. In general, this report concerns both chemists and chemical engineers, but in some cases the available data are limited to chemists.

In 1985, most chemists (66%) were employed in industry. Approximately 20% of chemists were in academia. Chemists employed by industry have been on the increase by 4% per annum while the employment rate of scientists in general has increased at a 10% annual rate since 1976 according to data published in the Occupational Employment Statistics Survey by the Bureau of Labor Statistics.

The unemployment rate for chemists was around 2%. The primary work activity of about 40% of chemists was in basic or applied research, while almost one-fourth worked in development. More than one-third (35%) were under the age of 40 and about 20% were over the age of 50. Women comprised about 13% of employed chemists.

In 1985, there were approximately 195,200 employed chemists and 163,100 employed chemical engineers at all degree levels as reported by the National Science Foundation in its 1985 NSF Science and Engineering Labor Market Study. Nearly one-half of the bachelor's degree recipients enrolled in graduate school full time, and one-third of the master's degree recipients enrolled in graduate school full-time, seeking professional or doctorate degrees.

Doctoral Chemists Characteristics

In 1985, U.S. universities awarded 31,201 doctoral degrees, of which 4,531 were in the physical sciences and 3,165 were in engineering.

These new entrants into the doctoral scientific pool brought the total number of doctoral scientists to 424,616, of whom 48,124 (11%) were chemists and 7,669 (2%) were chemical engineers as reported in the Summary Report 1985 Doctorate Recipients from United States Universities.

The numbers of doctoral degrees awarded in chemistry and chemical engineering have leveled off over the past ten years, although the composition within these ranks is changing drastically due to the increasing number of women entering the field and staying in school long enough to receive the terminal degree. Another segment which is changing the composition is the increasing number of foreign students earning doctorates at American universities. Ethnic representation has also been on the increase over the past ten years. Since the total scientific and engineering doctoral pool is only slightly increasing, white males are a decreasing fraction of the pool of doctorates.

Doctoral Intensity

The fraction of doctorate holders among all employed scientists and engineers is called the doctoral intensity rate. The doctoral intensity rate for chemists is higher than for all scientists. It is 22% for chemists and 16% for all scientists.

Sex

Of the total number of doctorate recipients, 66% are male and 34% are female. Women were less likely to be chemists than men. In 1985, 5% women scientists were chemists compared to 11% of men scientists who were chemists. Women also were 13% of employed chemists but 25% of employed scientists. At the doctoral level women were 9% of doctoral chemists compared to 91% men who were doctoral chemists.

Race/Ethnicity

The numbers of race/ethnic recipients of doctorates have increased in recent years. The 1985 percentages showed that non-U.S. citizens accounted for 14.5% of doctorate recipients. American Indians were 4.3%, Asians accounted for 22.2%, Blacks were 4.6%, whites were 14.0%, Puerto Ricans were 5.5%, Mexican-Americans were 10.3%, other Hispanics were 15.4%, and in the category of others there were 15.5%. Doctoral chemists and chemical engineers showed different proportions than did doctoral recipients; American Indians represented 0.8% of doctoral chemists and chemical engineers, Asians and Pacific Islanders were 9.3%, Blacks were 0.7%, whites were 89.0%, and others represented 1.0% of doctoral chemists.

Median Age at Doctorate

The median age at which doctorates were attained in the physical sciences was 33.3 years for non-U.S. citizens, for American Indians 33.2 years, 35.1 years for Puerto Ricans, 35.7 for Mexican-Americans and 33.1 for other minorities.

Median Time Lapse from BS to PhD

The process of attaining the PhD degree differs by racial/ethnic group and gender. During the 1975-85 period, the total time lapse between the year of baccalaureate and year of doctorate was quite variable.

The median time from the bachelor's degree to the doctorate in chemistry was 2.1 years for American Indians, 6.8 years for Blacks, 6.0 years for Hispanics. Women took about 2.5 years longer than men.

Work Function

In the work place, we used a different reference base to portray the characteristics of the doctoral scientists. First, we examine the years that a scientist had been working in his or her profession, then we described the other characteristics as referred to in Figure II.2.a.

Years of Professional Experience

About 31% of scientists have been working for less than 10 years, about 31% have been working for at least 10 years but less than 20 years, and about 38% have been working for more than 20 years.

Employment Status

In 1985, 88% of scientists and engineers were employed full-time, while 86% of chemists were employed full-time. Approximately 4% of scientists and engineers were employed part-time, while 2.4% of chemists were employed part-time. About 2% of chemists were unemployed and seeking employment.

Type of Employer

Business and industry employed 31% of doctoral scientists and engineers (S/E), but 55% of doctoral chemists. Over half (52.9%) of the S/E were employed in educational institutions, while 36.8% of chemists were employed in this sector. Thus, industry and business employed a larger fraction of chemists than other scientists. As for chemical engineers, 72% were employed in industry and business, and 25% were employed in educational institutions. The government sector employed 4% of the chemists and 2.6% of the chemical engineers.

Primary Work Activity

Of S/E, 33.1% worked in research and development (R&D). Twenty-eight percent were teaching, and 3.5% were doing consulting work. Chemists were differently distributed: 42% were in R&D, 21% were in management and administration, 21% were in teaching, and 2.0% did consulting work.

Area of Employment Interest

Almost five percent (4.9%) of S/E were in education (not teaching), and 17.4% were working in the area of health in 1985. Six percent (6.0%) were working in defense, 4.8% were in environment and pollution, 1.5% in space, 4.6% in food and agricultural chemistry, 6.7% in energy, 1.7% in community development/services, and 1.9% in transportation. On the other hand, 2.6% of chemists were in education (not teaching), 15% in health, 3.6% in defense, 8.7% in environment/pollution, 0.6% in space, 4.2% in food and agriculture, 9.0% in energy, 0.4% in community development services, and 1.0% in transportation.

Geographic Regions

Chemists were disproportionately distributed in various regions of the country. In New England there were 7%, in the Middle Atlantic region there were 24%, East North Central region there were 14%, in West North Central region there were 6%, and in the South Atlantic region there were 20%, in the East South Central region there were 4%, in the West South Central region there were 8%, in the Mountain region there were 3%, and in the Pacific region there were 13%.

Marital Status

In the pool of all scientists, 55% were married, while 39% were not married, and 6% were of unknown status. Physical scientists differ slightly: 52% were married, 43% were not married, and 5% were unknown status. Chemists were only slightly different: 51% married and 45% unmarried, and 4% of unknown status.

Specialty Area

Most chemists at the doctoral level (27%) were in organic chemistry, and 17% of chemistry doctorates were received in analytical chemistry.

Citizenship of Doctoral Recipients

Almost 1,300 doctorates were awarded to non-U.S. citizens. Canada was the country of origin of 40 doctorate recipients, Mexico and Central America had 24 recipients, South America had 75 recipients, Europe had 173, and Africa had 76. Asia had an outstandingly large number with 723 recipients, and 150 recipients were from unknown origin.

Post Graduation Commitment

In 1985 the distribution of new doctorates in the physical sciences showed 32% committed to employment in academe, with 54% committed to employment in industry, 12% committed to employment in government and 2% committed to other sectors. Most of those in the other category were committed to entering post-doctoral fellowship programs.

Academia

In 1985, 10,870 doctoral chemists and 1,334 doctoral chemical engineers were listed as teachers at four-year colleges and universities. Ninety percent of these chemists were men. In chemical engineering the picture is greatly contrasted, with men making up 98% of the full professors. At the associate professor level, there were 2,272, of whom 87% were men. At the assistant professorship level, there were 1,620 persons, 81% of whom were men.

Tenure

Although only 58% of all scientists who taught in universities or four-year colleges held tenured positions, about two-thirds of the chemists and chemical engineers enjoyed such security.

Salary

The median salary of doctoral chemists in 1985 was $46,000 whereas doctoral scientists' median salary was $42,500 annually. Doctoral chemical engineers fared much better; their median salary was $55,700, which was $3,300 more than other engineers received.

Age and Salary

The median salary for doctoral chemists less than age 30 was $37,600 annually. On the other end of the spectrum, those aged 50-59 averaged $52,150. Doctoral chemical engineers less than 30 years old received a median salary of almost $2000 more than did chemists of the same age cohort. At ages 50-59, the median salary of the chemical engineer was $71,100, about $19,000 more than the chemists of the same cohort.

Work Activities

The salaries were quite different for different work activities. The median salary for chemists in research was $45,800, and chemists in management positions received about $60,000 annually. The poorest paid activity was teaching, where the median salary was $37,600.

Graduates

Number of Chemistry Degrees Granted at All Levels

Accredited universities and colleges in the U.S. granted 5% of their baccalaureate degrees to persons with chemistry majors. Those colleges and universities granted 4% of their master's degrees to chemistry majors. At the doctorate level, 6% were awarded to chemists.

Graduate School Support

Doctoral students in science and engineering received a substantially larger amount of support from universities as the primary source of support during graduate school than did doctoral candidates in most fields. Persons in S/E received two-thirds to three-fourths from university related sources rather than from their own or family resources.

Postgraduation Commitment

The distribution of new doctorates in the physical sciences in 1985 showed 32.5% committed to employment in academe, with 53.9% committed to employment in industry, 11.5% committed to employment in government and 2.1% committed to other sectors. Most of those in the other category were committed to entering postdoctoral fellowship programs.

Postgraduation Plans

When there are fewer jobs available, more new PhDs will accept postdoctoral fellowships. An increase in postdoctoral fellowship usually indicates fewer full-time employment opportunities. There was an increase in the number of postdoctoral fellows in 1986 over 1985. Forty seven percent (47%) accepted postdoctoral fellowships, as compared with 31% in 1985. In 1986 13% of new PhDs in chemical engineering accepted postdoctoral fellowships, whereas only 5% had accepted such fellowships in 1985.

In 1986, 41% of BS chemistry graduates planned full-time graduate study in chemistry. That is a decrease from 1985, when 50% of those who received bachelor's degrees in chemistry planned to enter graduate school in chemistry. Of those new BS chemistry graduates who planned further full-time study in the fall of 1986, nearly as many planned to go into medicine or dentistry as into chemistry.

Table 2.1

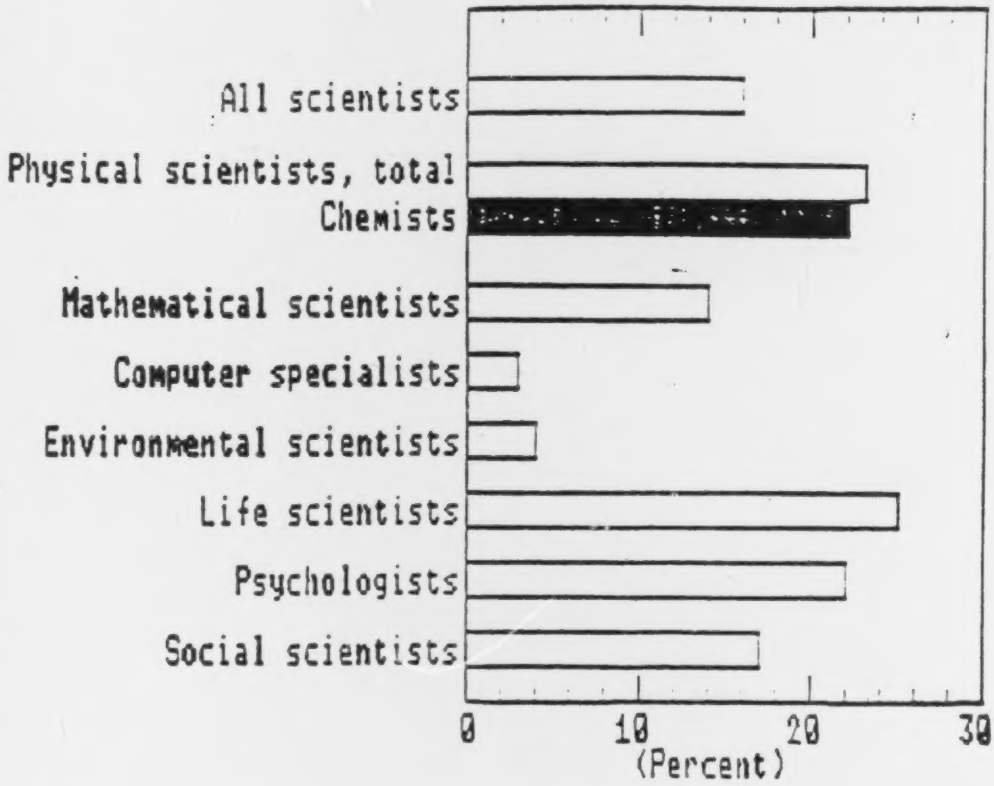
Statistical Profile of Doctorate Recipients in Chemistry and Chemical Engineering

	1985 Total	Chemistry	Chemical Engineering
Number in Field	11201	1836	3165
Male	65.7	80.3	93.7
Female	34.3	19.7	6.3
U.S. Citizenship	74.5	73.2	40.4
Non-U.S., Permanent Visa	4.2	4.7	10.0
Non-U.S., Temporary Visa	16.7	18.0	44.6
Unknown	4.6	4.1	5.0
Married	58.3	50.7	59.6
Not Married	35.6	44.7	33.5
Unknown	6.1	4.6	6.9
Median Age at Doctorate	33.3	28.9	30.9
Percent with Bacc in Same Field as Doctorate	55.9	81.6	74.2
Percent with Masters	80.0	37.4	86.7
Median Time Lapse From Bacc to Doct			
Total Time Yrs	10.2	6.4	8.1
Registered Time	6.8	5.5	5.8
Postdoctoral Study Plans	20.8	45.5	15.7
Fellowship	10.1	19.5	4.2
Research Assoc	8.4	24.6	9.4
Traineeship	1.0	.6	1.6
Other Study	1.3	.8	.4
Planned Employment After Doctorate	71.2	47.4	73.3
Educ Institution	41.3	8.0	26.0
Industry/Business	14.2	35.3	35.6
Government	7.5	2.7	8.2
Nonprofit	4.7	.5	1.4
Other & Unknown	3.4	1.0	2.2
Postdoc Status Unknown	8.0	7.1	11.0
Definite Postdoctoral Study	14.7	34.4	9.1
Seeking Postdoctoral Study	6.1	11.1	6.6
Definite Employment	51.7	37.6	53.1
Seeking Employment	19.6	9.9	20.2
Employment Activity After Doctorate			
Primary Activity			
R & D	27.5	77.7	64.5
Teaching	36.9	13.3	22.8
Administration	13.5	.7	1.8
Prof. Services	12.8	2.6	3.8
Other	3.0	1.7	1.8
Activity Unknown	6.3	3.9	5.3
Secondary Activity			
R & D	25.4	10.7	21.6
Teaching	13.0	4.1	13.1
Administration	9.4	15.2	8.5
Prof. Services	7.0	5.8	5.1
Other	2.1	1.0	1.0
No Secondary Activity	36.7	59.3	45.4
Unknown	6.3	3.9	5.3
Region of Employment After Doctorate			
New England	5.8	7.0	5.4
Middle Atlantic	15.3	24.8	14.5
East No Central	13.9	19.7	13.5
West No Central	6.7	6.5	4.4
South Atlantic	14.6	15.8	12.8
East So Central	3.9	2.0	2.7
West So Central	7.7	5.1	5.8
Mountain	4.6	2.0	5.8
Pacific & Insular	10.3	7.8	13.3
Foreign	10.3	4.6	16.1
Region Unknown	7.0	4.6	5.8

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

Figure II.1.a

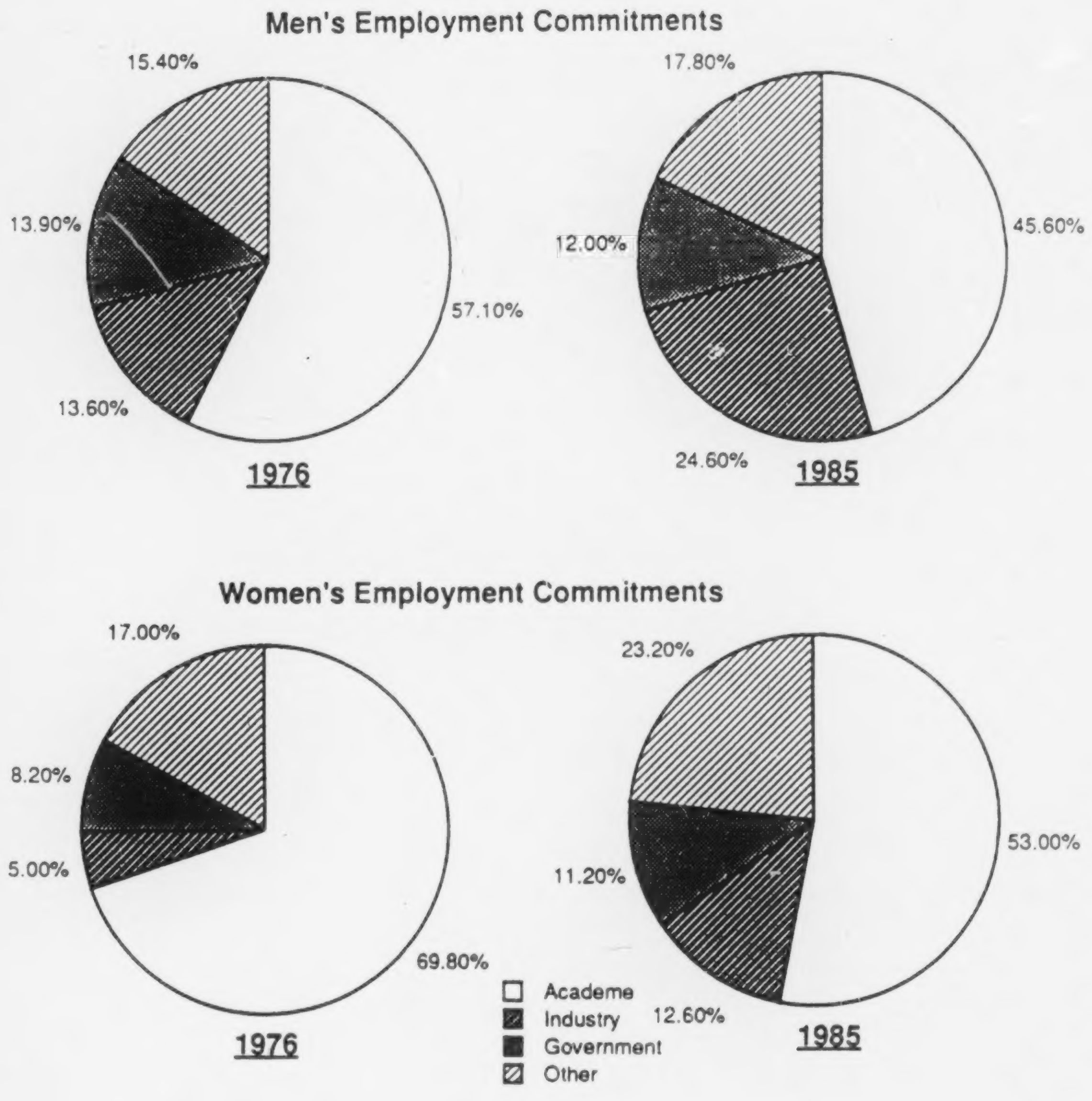
DOCTORAL INTENSITY RATE BY MAJOR FIELD: 1986



NOTE: Doctoral instensity is defined as doctoral S/E employment as a percent of total employment of scientists and engineers.

Source: NSF, Demographic Studies Group
Unpublished Data

Figure II.2.a



Definite employment commitments of new doctorate recipients, by sex, 1976 and 1985

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

Table 2.2

Characteristics of Doctoral Scientists and Engineers in the U.S.: 1985

CHARACTERISTICS	NUMBER	PERCENT
TOTAL	424,616	100.0
FIELD		
SCIENTISTS	356,720	84.0
PHYSICAL SCIENTISTS	73,074	17.2
CHEMISTS	48,124	11.3
PHYSICISTS/ASTRONOMERS	24,950	5.9
MATHEMATICAL SCIENTISTS	17,477	4.1
MATHEMATICIANS	14,604	3.4
STATISTICIANS	2,873	.7
COMPUTER/INFORMATION SPEC	14,985	3.5
ENVIRONMENTAL SCIENTISTS	17,974	4.2
EARTH SCIENTISTS	13,797	3.2
OCEANOGRAPHERS	1,985	.5
ATMOSPHERIC SCIENTISTS	2,192	.5
LIFE SCIENTISTS	109,866	25.9
BIOLOGICAL SCIENTISTS	65,084	15.3
AGRICULTURAL SCIENTISTS	16,856	4.0
MEDICAL SCIENTISTS	27,926	6.6
PSYCHOLOGISTS	54,872	12.9
SOCIAL SCIENTISTS	68,472	16.1
ECONOMISTS	19,068	4.5
SOCIOLOGISTS/ANTHRO	13,944	3.3
OTHER SOCIAL SCIENTISTS	35,460	8.4
ENGINEERS	67,896	16.0
AERO/ASTRO ENGINEERS	3,847	.9
CHEMICAL ENGINEERS	7,669	1.8
CIVIL ENGINEERS	6,708	1.6
ELEC./ELECTRON. ENGINEERS	14,577	3.4
MATERIALS SCI. ENGINEERS	7,433	1.8
MECHANICAL ENGINEERS	6,785	1.6
NUCLEAR ENGINEERS	2,377	.6
SYSTEMS DESIGN ENGINEERS	3,694	.9
OTHER ENGINEERS	14,806	3.5
SEX		
MEN	360,609	84.9
WOMEN	64,007	15.1
CITIZENSHIP		
USA	399,203	94.0
FOREIGN	25,104	5.9
NO REPORT	309	.1
RACE		
WHITE	377,945	89.0
BLACK	5,931	1.4
AM.INDIAN/ALSKN NATIVE	534	.1
ASIAN/PACIFIC ISLANDER	35,502	8.4
OTHER	325	.1
NO REPORT	4,379	1.0
ETHNICITY		
HISPANIC	6,192	1.5
NONHISPANIC	387,561	91.3
NO REPORT	30,863	7.3
AGE		
UNDER 30	6,123	1.4
30-34	49,783	11.7
35-39	79,701	18.8
40-44	87,751	20.7
45-49	63,698	15.0
50-54	44,509	10.5
55-59	35,914	8.5
60-64	29,532	7.0
65-69	17,631	4.2
70 OR OVER	9,784	2.3
NO REPORT	190	*
YEARS OF PROF. EXPERIENCE		
1 OR LESS YEARS	12,275	2.9
2-4 YEARS	48,308	11.4
5-9 YEARS	72,013	17.0
10-14 YEARS	73,260	17.3
15-19 YEARS	59,824	14.1
20-24 YEARS	36,761	8.7
25-29 YEARS	23,764	5.6
30-34 YEARS	21,261	5.0
35-39 YEARS	8,014	1.9
40 OR MORE YEARS	2,496	.6
NO REPORT	66,640	15.7
EMPLOYMENT STATUS		
FULL-TIME EMPLOYED	371,880	87.6
SCIENCE/ENGINEERING	339,773	80.0
OTHER/UNKNOWN FIELD	32,107	7.6
PART-TIME EMPLOYED	16,682	3.9
SCIENCE/ENGINEERING	13,979	3.3
OTHER/UNKNOWN FIELD	2,703	.6
POSTDOCTORATE	11,796	2.8
UNEMPLOYED/SEEKING EMPL	3,410	.8
NOT EMPLOYED/NOT SEEKING	3,899	.9
RETIRED	16,173	3.8
OTHER	776	.2

CHARACTERISTICS	NUMBER	PERCENT
TOTAL EMPLOYED	400,358	100.0
TYPE OF EMPLOYER		
BUSINESS/INDUSTRY	125,767	31.4
EDUCATIONAL INSTITUTION	211,611	52.9
4-YR. COLL./UNIV	202,019	50.5
2-YR. COLLEGES	6,001	1.5
ELEM/SEC. SCHOOLS	3,591	.9
HOSPITALS/CLINICS	11,352	2.8
NONPROFIT ORGS	13,617	3.4
FEDERAL GOVT	26,337	6.6
MILITARY/COMM. CORPS	1,875	.5
STATE GOVT	5,878	1.5
OTHER GOVT	2,339	.6
OTHER	1,213	.3
NO REPORT	369	.1
PRIMARY WORK ACTIVITY		
RESEARCH AND DEVELOPMENT	132,515	33.1
BASIC RESEARCH	61,451	15.3
APPLIED RESEARCH	49,088	12.3
DEVELOPMENT	21,976	5.5
MANAGEMENT/ADMINISTRATION	69,632	17.4
OF R&D	34,938	8.7
OF OTHER	34,694	8.7
TEACHING	111,717	27.9
CONSULTING	14,164	3.5
SALES/PROF. SERVICES	36,496	9.1
OTHER	24,761	6.2
NO REPORT	11,073	2.8
FEDERAL SUPPORT		
RECEIVING SUPPORT	129,336	32.3
NOT RECEIVING SUPPORT	209,222	52.3
STATUS UNKNOWN	6,413	1.6
NO REPORT	55,387	13.8
AREA OF NATIONAL INTEREST		
EDUCATION (NOT TEACHING)	19,510	4.9
HEALTH	69,834	17.4
DEFENSE	24,217	6.0
ENVIRONMENTAL/POLLUTION	19,171	4.8
SPACE	5,954	1.5
CRIME PREVENTION/CONTROL	3,801	.9
FOOD/OTHER AGR. PRODUCTS	18,454	4.6
ENERGY OR FUEL	26,975	6.7
OTHER NATURAL RESOURCES	8,536	2.1
COMMUNITY DEV./SERVICES	6,888	1.7
HOUSING	1,565	.4
TRANSPORT/COMMUNICATIONS	7,560	1.9
OTHER	18,748	4.7
NO REPORT	169,145	42.2

Source: NSF, Characteristics of Doctoral Scientists and Engineers in the U.S.

Table 2.3

Statistical Profile of Doctorate Recipients by Racial/Ethnic Group, 1985

	Total				American Indian	Asian			
	U.S.	Non-U.S.		Total	Total	U.S.	Non-U.S.		Total
		Perm.	Temp.				Perm.	Temp.	
Total Number	23241	1320	5214	31201	93	515	552	2522	3636
Male %	60.9	75.6	84.0	65.7	41.9	63.7	79.0	84.6	80.8
Female	39.1	24.4	16.0	34.3	58.1	36.3	21.0	15.4	19.2
Doctoral Field									
Physical Sciences1/ %	13.1	17.6	20.4	14.5	4.3	19.4	21.7	23.1	22.2
Engineering	5.5	23.9	27.1	10.1	1.1	17.5	34.6	33.6	31.7
Life Sciences	19.1	14.3	17.7	18.4	19.4	24.9	14.9	16.0	16.9
Social Sciences	19.5	15.8	12.8	18.3	18.3	12.0	10.1	11.0	11.0
Humanities	12.3	11.4	5.1	11.0	8.6	8.3	4.3	3.2	4.2
Education	24.7	9.7	10.9	21.5	41.9	13.4	5.3	7.2	7.8
Professional/Other	5.8	7.3	6.0	6.1	6.5	4.5	9.1	5.9	6.2
Median Age at Doctorate	33.5	33.1	32.7	33.3	35.9	32.6	32.7	32.4	32.4
Median Time Lapse BA-PhD									
Total Time Yrs	10.5	9.7	9.3	10.2	11.0	9.7	10.1	9.4	9.6
Registered Time	7.0	6.7	6.0	6.8	6.6	6.8	6.8	6.1	6.3
Graduate School Support									
Federal Fellow/Trainee%	16.0	5.7	5.8	13.1	21.5	21.2	5.3	4.8	7.2
GI Bill	4.2	.2	.1	3.1	5.4	1.4	.2	.0	.2
National Fellowship	3.8	2.5	4.0	3.6	7.5	4.5	1.3	3.8	3.4
Teaching Assistantship	46.6	51.9	41.2	43.8	35.5	47.4	50.9	43.7	44.7
Research Assistantship	37.8	51.1	50.5	38.8	31.2	51.1	63.4	60.3	58.7
Other University	29.5	28.3	22.9	27.1	21.5	29.5	24.3	21.5	22.8
Business/Employer	5.5	2.3	3.6	4.8	3.2	5.2	2.4	2.3	2.7
Self/Family Sources	81.8	71.6	50.3	72.4	81.7	71.8	65.4	49.8	54.6
Guaranteed Student Loan	28.1	17.9	.8	21.8	33.3	24.7	12.0	.6	5.7
Other Loans	11.1	7.4	2.0	8.9	11.8	11.5	5.1	1.2	3.2
Other	3.3	6.5	20.8	6.2	.0	2.3	2.9	12.6	9.5
Unknown	1.6	1.0	3.6	6.3	.0	1.2	.7	2.3	3.1
Postdoctoral Plans									
Postdoctoral Study %	20.3	19.8	28.6	20.8	18.3	30.5	20.5	32.8	30.1
Planned Employment	76.8	76.5	64.3	71.2	78.5	65.6	77.0	60.8	63.2
Educ. Institution	44.4	39.6	39.1	41.3	49.5	29.9	28.6	36.5	33.9
Industry/Business	14.9	27.0	11.7	14.2	16.1	22.1	38.8	14.4	19.0
Government	8.2	2.9	7.9	7.5	7.5	6.8	2.7	5.3	5.1
Non-profit	5.7	2.7	2.4	4.7	5.4	3.9	2.9	2.2	2.5
Other & Unknown	3.6	4.2	3.3	3.4	.0	2.9	4.0	2.5	2.7
Postdoct Status Unknown %	2.9	3.6	7.0	8.0	3.2	3.9	2.5	6.5	6.7
Definite Postdoct Study %	15.3	11.8	16.7	14.7	14.0	20.4	11.6	19.5	18.2
Seeking Postdoct Study	5.0	8.0	11.9	6.1	4.3	10.1	8.9	13.3	12.0
Definite Employment	56.5	45.2	45.5	51.7	59.1	45.2	45.5	42.6	42.9
Seeking Employment	20.3	31.3	18.8	19.6	19.4	20.4	31.5	18.2	20.3
Employment Location after Doctorate									
U.S.	92.0	81.7	31.8	82.8	89.1	88.0	82.1	39.7	53.7
Foreign	1.3	10.9	59.9	10.3	.0	4.3	8.8	50.6	36.9
Unknown	6.7	7.4	8.3	7.0	10.9	7.7	9.2	9.8	9.4

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

Statistical Profile of Doctorate Recipients by Racial/Ethnic Group, 1985 (Continued)

	Black				White				Puerto Rican
	U.S.	Non-U.S. Perm.	Non-U.S. Temp.	Total	U.S.	Non-U.S. Perm.	Non-U.S. Temp.	Total	Total
Total Number	909	131	393	1435	20641	533	1560	22750	145
Male	41.6	89.3	89.6	59.1	61.8	68.9	81.2	63.3	44.1
Female	58.4	10.7	10.4	40.9	38.2	31.1	18.8	36.7	55.9
Doctoral Field									
Physical Sciences1/	3.3	8.4	6.4	4.6	13.4	15.9	20.8	14.0	5.5
Engineering	2.1	11.5	9.7	5.0	5.3	17.1	22.9	6.8	3.4
Life Sciences	7.7	21.4	23.2	13.2	19.6	12.2	16.5	19.2	12.4
Social Sciences	19.1	23.7	17.6	19.2	19.7	18.9	13.7	19.2	17.2
Humanities	7.4	6.1	6.9	7.1	12.4	18.4	7.8	12.3	13.1
Education	52.3	21.4	27.2	42.6	23.8	10.9	11.5	22.6	39.3
Professional/Other	8.1	7.6	8.9	8.3	5.8	6.6	6.7	5.9	9.0
Median Age at Doctorate	37.7	34.8	34.9	36.6	33.3	33.3	32.1	33.2	35.1
Median Time Lapse BA-PhD									
Total Time Yrs	14.4	8.8	9.0	11.9	10.4	9.5	8.8	10.2	12.3
Registered Time	7.8	6.6	5.6	6.8	7.0	6.6	6.0	6.9	6.9
Graduate School Support									
Federal Fellow/Trainee%	18.9	3.8	10.2	15.1	15.6	5.8	6.1	14.7	26.9
GI Bill	3.7	.0	.0	2.4	4.3	.2	.1	3.9	4.1
National Fellowship	8.3	4.6	7.6	7.7	3.4	3.0	3.8	3.5	7.6
Teaching Assistantship	26.1	45.8	31.0	29.2	48.1	56.3	46.2	48.1	39.3
Research Assistantship	16.8	33.6	27.5	21.3	39.0	45.6	47.5	39.7	23.4
Other University	32.0	29.0	23.2	29.3	29.6	30.8	26.3	29.4	37.2
Business/Employer	5.5	3.8	6.1	5.5	5.6	2.1	4.7	5.5	12.4
Self/Family Sources	82.0	82.4	52.2	73.7	82.9	75.2	57.3	81.0	73.8
Guaranteed Student Loan	27.8	36.6	1.5	21.4	28.2	18.8	1.0	26.1	49.7
Other Loans	15.8	16.8	2.5	12.3	10.7	7.3	3.1	10.1	22.1
Other	3.4	5.3	29.3	10.7	3.3	9.2	25.6	5.0	5.5
Unknown	1.7	1.5	3.6	2.3	.7	.9	1.3	.7	.0
Postdoctoral Plans									
Postdoctoral Study	8.4	13.0	20.1	12.0	20.9	20.5	27.4	21.3	11.7
Planned Employment	86.7	83.2	74.8	83.0	77.2	75.0	68.1	76.5	86.9
Educ. Institution	58.5	51.9	45.0	54.1	44.5	46.7	41.3	44.3	57.9
Industry/Business	6.5	16.8	5.1	7.0	15.4	19.1	11.4	15.2	6.9
Government	11.4	5.3	15.3	11.9	8.1	2.3	9.1	8.1	9.0
Non-profit	4.4	1.5	3.8	4.0	5.8	2.8	2.4	5.5	7.6
Other & Unknown	5.8	7.6	5.6	5.9	3.4	4.1	3.8	3.5	5.5
Postdoct Status Unknown	5.0	3.8	5.1	5.0	1.9	4.5	4.5	2.2	1.4
Definite Postdoct Study	5.7	7.6	8.1	6.6	15.9	12.8	16.7	15.9	7.6
Seeking Postdoct Study	2.6	5.3	12.0	5.4	5.0	7.7	10.7	5.5	4.1
Definite Employment	60.2	35.1	46.3	54.0	57.3	46.3	48.8	56.5	64.1
Seeking Employment	26.5	48.1	28.5	29.0	19.9	28.7	19.2	20.1	22.8
Employment Location after Doctorate									
U.S.	87.0	73.9	16.5	69.7	92.5	83.4	33.1	88.8	91.4
Foreign	.2	23.9	73.1	18.7	1.2	9.7	60.8	4.9	1.1
Unknown	12.8	2.2	10.4	11.6	6.2	6.9	6.2	6.2	7.5

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

Table 2.3 (cont'd)

Statistical Profile of Doctorate Recipients by Racial/Ethnic Group, 1985 (Cont'd)

	Mexican-American				Other Hispanic				Other & Unknown		
	U.S.	Non-U.S.		Total	U.S.	Non-U.S.		Total	U.S.	Non-U.S.	Total
		Perm.	Temp.			Perm.	Temp.				
Total Number	180	11	22	213	234	61	337	638	524	412	2291
Male	60.0	72.7	77.3	62.4	53.8	68.9	81.9	69.9	69.7	98.8	71.5
Female	40.0	27.3	22.7	37.6	46.2	31.1	18.1	30.1	30.3	11.2	28.5
Doctoral Field											
Physical Sciences1/	8.3	27.3	18.2	10.3	8.1	14.8	20.8	15.4	19.5	15.3	15.1
Engineering	2.2	18.2	18.2	4.7	3.0	6.6	17.8	11.1	10.7	28.4	13.4
Life Sciences	8.9	9.1	40.9	12.2	17.5	19.7	30.9	24.6	17.6	14.1	15.3
Social Sciences	23.9	9.1	13.6	22.1	22.6	19.7	10.4	15.8	20.2	18.4	21.0
Humanities	12.2	18.2	4.5	11.7	23.5	24.6	5.3	14.3	13.0	4.4	10.5
Education	39.4	18.2	4.5	34.7	22.2	11.5	13.1	16.5	14.5	14.6	17.5
Professional/Other	5.0	.0	.0	4.2	3.0	3.3	1.8	2.4	4.6	4.9	7.2
Median Age at Doctorate	36.0	34.3	34.0	35.7	34.9	35.9	34.2	34.5	32.5	33.5	33.1
Median Time Lapse BA-PhD											
Total Time Yrs	11.8	9.5	11.5	11.7	10.6	9.5	9.5	9.9	9.6	9.5	9.9
Registered Time	7.3	6.8	6.0	7.2	7.6	6.3	5.3	6.2	7.0	6.2	6.6
Graduate School Support											
Federal Fellow/Trainee	29.4	18.2	9.1	26.8	20.5	13.1	7.1	12.5	9.9	5.3	3.2
GI Bill	3.9	.0	.0	3.3	3.8	.0	.0	1.4	1.3	.0	.3
National Fellowship	15.6	.0	4.5	13.6	6.4	6.6	5.3	5.8	4.2	1.5	1.3
Teaching Assistantship	41.1	36.4	27.3	39.4	42.7	47.5	32.6	37.6	30.7	23.8	11.5
Research Assistantship	25.6	27.3	50.0	28.2	29.5	39.3	41.8	36.7	27.7	29.6	11.9
Other University	38.3	27.3	18.2	35.7	34.2	41.0	24.9	29.8	18.7	18.0	7.6
Business/Employer	4.4	.0	.0	3.8	4.3	1.6	5.3	4.7	3.2	4.4	1.5
Self/Family Sources	82.8	90.9	36.4	78.4	83.3	73.8	43.0	61.0	46.8	32.8	16.7
Guaranteed Student Loan	34.4	9.1	.0	29.6	34.2	23.0	1.5	15.5	14.3	2.4	3.7
Other Loans	14.4	9.1	4.5	13.1	16.2	9.8	4.5	9.2	8.4	1.0	2.1
Other	2.8	36.4	59.1	10.3	3.8	11.5	39.2	23.4	2.1	26.9	5.3
Unknown	1.1	.0	.0	.9	1.7	.0	1.8	1.7	38.7	21.6	71.5
Postdoctoral Plans											
Postdoctoral Study	12.8	27.3	22.7	14.6	20.5	26.2	25.5	23.7	16.0	17.5	6.9
Planned Employment	85.0	72.7	72.7	83.1	75.2	72.1	70.6	72.3	47.5	57.3	21.6
Educ. Institution	51.1	54.5	40.9	50.2	50.9	50.8	45.7	48.0	22.3	35.2	11.7
Industry/Business	10.0	18.2	9.1	10.3	6.8	11.5	8.0	7.8	12.4	7.8	4.3
Government	12.8	.0	18.2	12.7	5.6	3.3	10.1	7.8	4.0	9.5	2.7
Non-profit	7.2	.0	.0	6.1	5.6	4.9	2.7	3.9	2.3	1.5	.8
Other & Unknown	3.9	.0	4.5	3.8	6.4	1.6	4.2	4.7	6.5	3.4	2.1
Postdoct Status Unknown	2.2	.0	4.5	2.3	4.3	1.6	3.9	4.1	36.5	25.2	71.6
Definite Postdoct Study	8.3	18.2	22.7	10.3	13.7	16.4	14.8	14.4	10.3	8.5	3.9
Seeking Postdoct Study	4.4	9.1	.0	4.2	6.8	9.8	10.7	9.2	5.7	9.0	2.9
Definite Employment	60.0	45.5	59.1	59.2	47.9	55.7	54.3	52.0	29.4	42.2	14.7
Seeking Employment	25.0	27.3	13.6	23.9	27.4	16.4	16.3	20.2	18.1	15.0	6.9
Employment Location after Doctorate											
U.S.	91.7	80.0	7.7	82.5	85.7	82.4	17.5	47.6	83.8	14.4	47.5
Foreign	.9	20.0	76.9	9.5	3.6	11.8	78.7	46.1	1.3	75.9	40.1
Unknown	7.4	.0	15.4	7.9	10.7	5.9	3.8	6.3	14.9	9.8	12.5

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

Table 2.4

Number of All Doctoral Chemists and Chemical Engineers by Sex, Race and Employment Status: 1985

		EMPLOYED FULL-TIME			EMPLOYED PART-TIME							
	TOTAL	TOTAL	SCI/ ENG.	OTHER/ UNKNOWN FIELD	TOTAL	SCI/ ENG.	OTHER/ UNKNOWN FIELD	POST-DOC-TORAL	UNEMP/ SEEKING EMP.	UNEMP/ NOT SEEKING EMP.	RE-TIRED	OTHER
CHEMISTS												
TOTAL....................	48,124	41,191	37,677	3,514	1,198	851	347	1,346	507	458	3,304	120
SEX												
MEN....................	43,817	37,938	34,735	3,203	896	623	273	1,096	427	230	3,123	107
WOMEN..................	4,307	3,253	2,942	311	302	228	74	250	80	228	181	13
RACE												
WHITE..................	42,726	36,392	33,115	3,277	1,077	770	307	1,025	485	413	3,214	120
BLACK..................	380	289	278	11	*	*	*	91	*	*	*	*
AM.INDIAN/ALSKN NATIVE	41	41	41	*	*	*	*	*	*	*	*	*
ASIAN/PACIFIC ISLANDER	4,477	3,971	3,801	170	121	81	40	228	22	45	90	*
OTHER..................	9	9	7	2	*	*	*	*	*	*	*	*
NO REPORT..............	491	489	435	54	*	*	*	2	*	*	*	*
CHEMICAL ENGINEERS												
TOTAL....................	7,669	7,062	6,202	860	58	58	*	2	129	6	397	15
SEX												
MEN....................	7,556	6,965	6,112	853	56	56	*	*	125	*	395	15
WOMEN..................	113	97	90	7	2	2	*	2	4	6	2	*
RACE												
WHITE..................	5,553	5,070	4,302	768	58	58	*	2	73	3	332	15
BLACK..................	66	66	63	3	*	*	*	*	*	*	*	*
AM.INDIAN/ALSKN NATIVE	3	3	3	*	*	*	*	*	*	*	*	*
ASIAN/PACIFIC ISLANDER	2,047	1,923	1,834	89	*	*	*	*	56	3	65	*
OTHER..................	*	*	*	*	*	*	*	*	*	*	*	*
NO REPORT..............	*	*	*	*	*	*	*	*	*	*	*	*

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

Table 2.5

Number of All Employed Doctoral Chemists and Chemical Engineers by Age and Type of Employer: 1985

	TOTAL EMPL	BUS-INESS/ INDUS-TRY	EDUCATIONAL INSTITUTIONS				HOS-PITAL/ CLINIC	NON-PROFIT ORGS	FED-ERAL GOV'T	MILI-TARY/ COMM. CORPS	STATE GOV'T	OTHER GOV'T	OTHER	NO REPORT
			TOTAL	4-YEAR COLL/ UNIV	2-YEAR COLL	ELEM/ SEC. SCHOOL								
CHEMISTS														
TOTAL....................	43,735	24,067	16,073	15,021	837	215	368	1,048	1,752	79	146	170	*	32
UNDER 30..............	1,288	801	425	425	*	*	*	2	28	29	*	*	*	3
30-34....................	5,740	3,519	1,862	1,805	35	22	20	135	176	*	*	22	*	6
35-39....................	6,762	4,193	2,093	1,955	110	28	78	147	209	3	8	26	*	5
40-44....................	8,368	4,523	3,037	2,771	226	40	83	125	460	47	76	14	*	3
45-49....................	7,216	3,558	3,020	2,786	182	52	34	301	257	*	5	41	*	*
50-54....................	4,954	2,645	1,926	1,817	105	4	67	105	196	*	5	10	*	*
55-59....................	4,642	2,523	1,644	1,561	62	21	54	65	254	*	45	57	*	*
60-64....................	3,001	1,650	1,117	1,047	64	6	21	41	158	*	7	*	*	7
65-69....................	1,626	581	905	810	53	42	11	125	*	*	*	*	*	4
70 OR OVER..............	127	67	40	40	*	*	*	2	14	*	*	*	*	4
NO REPORT...............	11	7	4	4	*	*	*	*	*	*	*	*	*	*
CHEMICAL ENGINEERS														
TOTAL....................	7,122	5,097	1,778	1,733	1	44	*	64	183	*	*	*	*	*
UNDER 30..............	111	31	78	78	*	*	*	*	2	*	*	*	*	*
30-34....................	1,091	699	390	390	*	*	*	2	*	*	*	*	*	*
35-39....................	1,473	1,145	287	287	*	*	*	28	13	*	*	*	*	*
40-44....................	1,283	1,027	130	86	*	44	*	34	92	*	*	*	*	*
45-49....................	1,293	952	341	341	*	*	*	*	*	*	*	*	*	*
50-54....................	910	596	253	253	*	*	*	*	61	*	*	*	*	*
55-59....................	438	316	107	106	1	*	*	*	15	*	*	*	*	*
60-64....................	395	282	113	113	*	*	*	*	*	*	*	*	*	*
65-69....................	113	34	79	79	*	*	*	*	*	*	*	*	*	*
70 OR OVER..............	15	15	*	*	*	*	*	*	*	*	*	*	*	*
NO REPORT...............	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

Table 2.6

Number of All Employed Doctoral Chemists and Chemical Engineers by Years of Professional Experience, and Primary Work Activity: 1985

		RESEARCH AND DEVELOPMENT				MANAGEMENT OR ADMIN							
	TOTAL EMPL	TOTAL	BASIC RE-SEARCH	APPL'D RE-SEARCH	DEVEL-OPMENT	TOTAL	OF R&D	OF OTHER	TEACH-ING	CON-SULT-ING	SALES/ PROF. SER-VICES	OTHER	NO REPORT
CHEMISTS													
TOTAL	43,735	18,373	7,991	7,809	2,573	9,039	6,823	2,216	9,128	884	1,581	3,675	1,055
1 OR LESS YEARS	713	577	395	171	11	5	2	3	25	*	9	94	3
2-4 YEARS	4,363	3,186	1,735	1,137	314	144	130	14	428	47	133	348	77
5-9 YEARS	6,047	3,397	1,353	1,507	537	827	788	39	858	71	251	546	97
10-14 YEARS	6,148	2,483	922	985	576	1,480	1,258	222	1,153	39	273	633	87
15-19 YEARS	7,370	2,234	984	901	349	1,768	1,399	369	2,360	4	261	625	118
20-24 YEARS	4,764	1,278	578	480	220	1,467	1,005	462	1,301	187	198	320	13
25-29 YEARS	3,540	1,049	384	444	221	862	671	191	991	148	141	304	45
30-34 YEARS	2,905	946	324	614	8	789	524	265	598	116	124	272	60
35-39 YEARS	1,149	513	269	161	83	247	122	125	184	109	38	20	38
40 OR MORE YEARS	491	101	97	4	*	83	83	*	91	77	7	132	*
NO REPORT	6,245	2,609	950	1,405	254	1,367	841	526	1,139	86	146	381	517
CHEMICAL ENGINEERS													
TOTAL	7,122	3,156	446	1,549	1,161	1,756	1,214	542	904	225	425	350	306
1 OR LESS YEARS	134	134	28	105	1	*	*	*	*	*	*	*	*
2-4 YEARS	734	531	143	275	113	31	31	*	108	29	*	35	*
5-9 YEARS	1,151	765	79	387	299	75	75	*	100	9	125	2	75
10-14 YEARS	1,149	526	17	273	236	279	253	26	134	*	74	121	15
15-19 YEARS	877	247	46	111	90	464	375	89	44	*	45	77	*
20-24 YEARS	887	285	55	105	125	230	125	105	182	120	*	35	35
25-29 YEARS	522	189	15	50	124	80	31	49	35	52	135	31	*
30-34 YEARS	356	151	15	75	61	80	*	80	47	*	31	47	*
35-39 YEARS	75	*	*	*	*	30	*	30	15	15	15	*	*
40 OR MORE YEARS	15	*	*	*	*	*	*	*	*	*	*	*	15
NO REPORT	1,222	328	48	168	112	487	324	163	239	*	*	2	166

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

Table 2.7

Number of All Doctoral Chemists and Chemical Engineers Who Are University or Four-Year College Teachers by Sex and Academic Rank: 1985

	TOTAL	PROFESSOR	ASSOCIATE PROFESSOR	ASSISTANT PROFESSOR	INSTRUCTOR	ADMINISTRATOR	OTHER	NO REPORT
CHEMISTS								
TOTAL	10,870	6,156	2,272	1,620	155	111	474	82
MEN	9,790	5,838	1,987	1,311	115	104	357	78
WOMEN	1,080	318	285	309	40	7	117	4
CHEMICAL ENGINEERS								
TOTAL	1,334	565	348	396	*	16	9	*
MEN	1,303	564	343	373	*	16	7	*
WOMEN	31	1	5	23	*	*	2	*

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

Table 2.8

NUMBER OF EMPLOYED DOCTORAL SCIENTISTS AND ENGINEERS BY FIELD, SUPPORTING AGENCY AND TYPE OF EMPLOYER: 1985

FIELD AND SUPPORTING AGENCY	TOTAL EMPL	BUSINESS/ INDUSTRY	EDUCATIONAL INSTITUTIONS				HOSPITAL/ CLINIC	NONPROFIT ORGS	FEDERAL GOV'T	MILITARY/ COMM. CORPS	STATE GOV'T	OTHER GOV'T	OTHER	NO REPORT
			TOTAL	4-YEAR COLL/ UNIV	2-YEAR COLL	ELEM/ SEC. SCHOOL								
CHEMISTS														
TOTAL EMPLOYED..........	43,735	24,067	16,073	15,021	837	215	368	1,048	1,752	79	146	170	*	32
TOTAL SUPPORTED........	9,361	1,643	5,042	4,993	46	3	68	645	1,752	76	45	90	*	*
NASA..................	487	126	240	240	*	*	*	*	121	*	*	*	*	*
NSF...................	1,895	125	1,756	1,756	*	*	9	5	*	*	*	*	*	*
EPA...................	819	202	117	117	*	*	*	153	253	*	4	90	*	*
DOE...................	2,068	623	1,108	1,108	*	*	*	219	118	*	*	*	*	*
NRC...................	37	35	*	*	*	*	*	1	*	*	1	*	*	*
AID...................	49	*	7	7	*	*	*	42	*	*	*	*	*	*
DHHS, TOTAL...........	2,902	137	2,075	2,075	*	*	25	265	385	14	1	*	*	*
NIH.................	2,569	125	2,060	2,060	*	*	25	224	121	14	*	*	*	*
ADAMHA..............	126	39	19	19	*	*	*	68	*	*	*	*	*	*
OTHER DHHS..........	298	14	7	7	*	*	*	12	264	*	1	*	*	*
ED....................	24	7	17	14	*	3	*	*	*	*	*	*	*	*
DOD...................	2,132	738	638	635	3	*	*	265	429	62	*	*	*	*
COMMERCE..............	181	31	39	39	*	*	*	*	108	*	3	*	*	*
USDA..................	471	13	185	185	*	*	7	13	253	*	*	*	*	*
DOT...................	30	28	2	*	2	*	*	*	*	*	*	*	*	*
JUSTICE...............	5	*	*	*	*	*	*	*	5	*	*	*	*	*
HUD...................	8	*	8	8	*	*	*	*	*	*	*	*	*	*
INTERIOR..............	159	22	43	2	41	*	*	*	56	*	38	*	*	*
OTHER.................	230	2	40	40	*	*	44	40	103	*	1	*	*	*
SOURCE UNKNOWN........	76	37	35	35	*	*	*	2	2	*	*	*	*	*
SOURCE NOT REPORTED...	64	13	51	51	*	*	*	*	*	*	*	*	*	*

NUMBER OF EMPLOYED DOCTORAL SCIENTISTS AND ENGINEERS BY FIELD, SUPPORTING AGENCY AND TYPE OF EMPLOYER: 1985

FIELD AND SUPPORTING AGENCY	TOTAL EMPL	BUSINESS/ INDUSTRY	EDUCATIONAL INSTITUTIONS				HOSPITAL/ CLINIC	NONPROFIT ORGS	FEDERAL GOV'T	MILITARY/ COMM. CORPS	STATE GOV'T	OTHER GOV'T	OTHER	NO REPORT
			TOTAL	4-YEAR COLL/ UNIV	2-YEAR COLL	ELEM/ SEC. SCHOOL								
CHEMICAL ENGINEERS														
TOTAL EMPLOYED..........	7,122	5,097	1,778	1,733	1	44	*	64	183	*	*	*	*	*
TOTAL SUPPORTED........	1,497	621	631	631	*	*	*	62	183	*	*	*	*	*
NASA..................	120	54	66	66	*	*	*	*	*	*	*	*	*	*
NSF...................	416	*	413	413	*	*	*	*	3	*	*	*	*	*
EPA...................	119	94	*	*	*	*	*	25	*	*	*	*	*	*
DOE...................	835	531	184	184	*	*	*	28	92	*	*	*	*	*
NRC...................	15	*	*	*	*	*	*	*	15	*	*	*	*	*
AID...................	35	35	*	*	*	*	*	*	*	*	*	*	*	*
DHHS, TOTAL...........	96	*	96	96	*	*	*	*	*	*	*	*	*	*
NIH.................	96	*	96	96	*	*	*	*	*	*	*	*	*	*
ADAMHA..............	*	*	*	*	*	*	*	*	*	*	*	*	*	*
OTHER DHHS..........	*	*	*	*	*	*	*	*	*	*	*	*	*	*
ED....................	*	*	*	*	*	*	*	*	*	*	*	*	*	*
DOD...................	229	120	69	69	*	*	*	25	15	*	*	*	*	*
COMMERCE..............	*	*	*	*	*	*	*	*	*	*	*	*	*	*
USDA..................	61	*	15	15	*	*	*	*	46	*	*	*	*	*
DOT...................	*	*	*	*	*	*	*	*	*	*	*	*	*	*
JUSTICE...............	*	*	*	*	*	*	*	*	*	*	*	*	*	*
HUD...................	*	*	*	*	*	*	*	*	*	*	*	*	*	*
INTERIOR..............	12	*	*	*	*	*	*	*	12	*	*	*	*	*
OTHER.................	25	*	25	25	*	*	*	*	*	*	*	*	*	*
SOURCE UNKNOWN........	*	*	*	*	*	*	*	*	*	*	*	*	*	*
SOURCE NOT REPORTED...	9	*	*	*	*	*	*	9	*	*	*	*	*	*
NOT SUPPORTED..........	4,433	3,709	722	677	1	44	*	2	*	*	*	*	*	*
SUPPORT STATUS UNKNOWN.	44	*	44	44	*	*	*	*	*	*	*	*	*	*
NO REPORT..............	1,148	767	381	381	*	*	*	*	*	*	*	*	*	*

Source: NSF, Characteristics of Doctoral
Scientists and Engineers in the
U.S.

Table 2.9

Number of All Doctoral Chemists by Geographic Division and State: 1985

GEOGRAPHIC DIVISION AND STATE	TOTAL	CHEM-ISTS
TOTAL	73,074	48,124
NEW ENGLAND	5,668	3,252
CONNECTICUT	1,699	1,032
MAINE	246	118
MASSACHUSETTS	3,166	1,659
NEW HAMPSHIRE	100	35
RHODE ISLAND	263	247
VERMONT	194	161
MIDDLE ATLANTIC	15,651	11,515
NEW JERSEY	5,055	4,017
NEW YORK	6,792	4,490
PENNSYLVANIA	3,804	3,008
EAST NORTH CENTRAL	11,307	8,394
ILLINOIS	3,039	2,191
INDIANA	1,260	955
MICHIGAN	2,337	1,707
OHIO	3,639	2,936
WISCONSIN	1,032	605
WEST NORTH CENTRAL	3,830	2,915
IOWA	483	249
KANSAS	423	332
MINNESOTA	1,201	938
MISSOURI	1,111	899
NORTH DAKOTA	150	147
NEBRASKA	326	280
SOUTH DAKOTA	136	70
SOUTH ATLANTIC	13,543	8,524
DELAWARE	2,158	1,974
DISTRICT OF COLUMBIA	1,442	572
FLORIDA	1,301	737
GEORGIA	962	703
MARYLAND	2,800	1,143
NORTH CAROLINA	1,504	1,235
SOUTH CAROLINA	796	574
VIRGINIA	1,974	1,075
WEST VIRGINIA	606	511
EAST SOUTH CENTRAL	2,848	1,974
ALABAMA	608	329
KENTUCKY	657	543
MISSISSIPPI	182	161
TENNESSEE	1,401	941
WEST SOUTH CENTRAL	5,046	3,924
ARKANSAS	200	166
LOUISIANA	772	658
OKLAHOMA	450	410
TEXAS	3,624	2,690
MOUNTAIN	4,095	1,577
ARIZONA	519	226
COLORADO	818	444
IDAHO	141	74
MONTANA	51	25
NEW MEXICO	1,857	373
NEVADA	94	40
UTAH	453	233
WYOMING	162	162
PACIFIC	11,086	6,049
ALASKA	69	67
CALIFORNIA	8,920	4,678
HAWAII	293	198
OREGON	551	427
WASHINGTON	1,116	577
U.S. POSSESSIONS	137	102

Source: NSF, Characteristics of Doctoral Scientists and Engineers in the U.S.

Table 2.10

Marital Status of Doctorate Recipients by Field of Doctorate, 1985

Total All Doctorates

		1985 Total	Physics and Astronomy	Chemistry	Earth, Atmospheric and Marine Sciences	Physical Sciences	Mathematics	Computer Sciences	Engineering	EMP Fields	Biochemistry	Other Biosciences	Biosciences	Health Sciences	Agricultural Sciences	Life Sciences
Number in Field		31201	1078	1836	617	3531	689	311	3165	7696	579	3187	3766	724	1258	5748
Male	%	65.7	90.5	80.3	82.0	83.7	84.6	89.4	93.7	88.1	68.2	67.2	67.4	40.1	84.7	67.7
Female		34.3	9.5	19.7	18.0	16.3	15.4	10.6	6.3	11.9	31.8	32.8	32.6	59.9	15.3	32.3
U.S. Citizenship	%	74.5	64.6	73.2	72.0	70.3	54.6	60.8	40.4	56.2	81.2	83.3	83.0	74.3	60.9	77.1
Non-U.S., Permanent Visa		4.2	4.5	4.7	5.0	4.7	6.1	7.7	10.0	7.1	4.8	2.5	2.9	4.7	3.7	3.3
Non-U.S., Temporary Visa		16.7	26.8	18.0	19.0	20.8	34.7	28.6	44.6	32.2	11.9	11.1	11.2	13.4	32.0	16.0
Unknown		4.6	4.2	4.1	4.1	4.1	4.6	2.9	5.0	4.5	2.1	3.1	2.9	7.6	3.3	3.6
Married	%	58.3	49.8	50.7	57.4	51.6	51.4	58.8	59.6	55.1	51.5	55.3	54.7	56.5	67.3	57.7
Not Married		35.6	44.7	44.7	37.0	43.4	42.2	37.0	33.5	39.0	44.2	40.3	40.9	33.7	28.2	37.2
Unknown		6.1	5.5	4.6	5.7	5.1	6.4	4.2	6.9	5.9	4.3	4.5	4.4	9.8	4.5	5.1

Source: NSF Unpublished Data

Table 2.11

RECENT DOCTORATE RECIPIENTS

Postgraduation Employment Commitments, by Employment Sector, Sex, and Minority Status, 1975 and 1985 (U.S. Citizens)

	Academe		Industry		Government		Other	
	1975	1985	1975	1985	1975	1985	1975	1985
Total U.S. Citizens	60.6*	48.1	11.5	19.4	13.1	12.1	14.8	20.4
Men	57.8	45.4	13.5	23.7	14.3	12.5	14.5	18.3
Women	70.9	52.5	4.6	12.5	8.7	11.3	15.8	23.7
Asian	50.7	39.9	23.3	37.2	16.0	12.1	10.0	10.8
Men	48.0	37.2	28.0	43.9	15.2	9.5	8.8	9.5
Women	64.0	45.3	0.0	24.0	20.0	17.3	16.0	13.3
Black	67.6	49.6	2.5	6.0	11.9	13.9	18.0	30.4
Men	66.0	42.2	3.4	9.2	11.7	19.7	18.3	28.9
Women	69.4	54.6	0.9	4.0	12.2	10.1	17.6	31.4
Hispanic	70.7	56.7	10.6	11.4	8.1	11.1	10.6	20.8
Men	70.7	55.6	11.0	14.8	7.3	8.6	11.0	21.0
Women	70.6	57.9	8.8	7.6	11.8	13.8	8.8	20.7
White	60.3	48.0	11.8	19.9	13.2	12.0	14.7	20.1
Men	57.4	45.5	13.7	23.9	14.5	12.5	14.4	18.1
Women	71.1	52.2	4.9	13.2	8.3	11.2	15.7	23.4

* Proportion of those with definite employment commitments.

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

Table 2.12

Status of Postgraduation Plans, by Field, Sex, and Race, 1985 (US Citizens)

	Total Fields	Physical Sciences	Engi-neering	Life Sciences	Social Sciences	Human-ities	Education	Profession & Other
Definite	68.3	72.9	69.0	67.7	57.6	67.4	69.7	75.0
Study	21.2	28.1	6.0	51.2	10.2	0.0	3.0	0.0
Employment	47.1	44.8	63.1	16.5	47.5	67.4	66.7	75.0
Negotiating	9.3	4.2	15.5	11.0	10.2	4.7	6.1	15.0
Study	2.2	1.0	0.0	7.9	0.0	0.0	0.0	0.0
Employment	7.1	3.1	15.5	3.1	10.2	4.7	6.1	15.0
Seeking	22.4	22.9	15.5	21.3	32.2	27.9	24.2	10.0
Study	8.3	13.5	1.2	13.4	10.2	4.7	3.0	0.0
Employment	14.1	9.4	14.3	7.9	22.0	23.3	21.2	10.0
Blacks								
Definite	69.3	58.6	70.6	74.6	59.9	83.3	69.5	78.3
Study	6.0	13.8	0.0	26.9	6.6	6.7	2.2	7.2
Employment	63.3	44.8	70.6	47.8	53.3	76.7	67.3	71.0
Negotiating	7.6	17.2	29.4	7.5	10.8	1.7	6.8	1.4
Study	0.6	10.3	0.0	3.0	0.0	0.0	0.0	0.0
Employment	7.1	6.9	29.4	4.5	10.8	1.7	6.8	1.4
Seeking	23.0	24.1	0.0	17.9	29.3	15.0	23.7	20.3
Study	2.2	3.4	0.0	4.5	4.8	1.7	1.3	0.0
Employment	20.8	20.7	0.0	13.4	24.6	13.3	22.4	20.3
Hispanics								
Definite	68.3	78.6	75.0	70.7	66.4	65.2	67.2	67.9
Study	10.7	16.7	6.3	41.3	6.0	8.7	2.3	0.0
Employment	57.6	61.9	68.8	29.3	60.3	56.5	64.9	67.9
Negotiating	9.0	11.9	25.0	8.0	12.9	5.4	6.3	10.7
Study	1.7	2.4	0.0	4.0	2.6	0.0	0.6	3.6
Employment	7.4	9.5	25.0	4.0	10.3	5.4	5.7	7.1
Seeking	22.7	9.5	0.0	21.3	20.7	29.3	26.4	21.4
Study	3.9	0.0	0.0	8.0	2.6	6.5	3.4	0.0
Employment	18.8	9.5	0.0	13.3	18.1	22.8	23.0	21.4
Whites								
Definite	74.6	79.6	81.1	75.9	70.3	64.2	75.9	83.9
Study	16.2	30.1	8.3	44.3	10.9	3.1	1.6	1.2
Employment	58.4	49.4	72.7	31.6	59.5	61.0	74.3	82.7
Negotiating	7.6	8.0	10.0	8.1	9.0	6.6	6.5	5.2
Study	1.7	3.2	1.4	4.0	1.7	0.4	0.3	0.1
Employment	5.9	4.7	8.6	4.2	7.4	6.1	6.2	5.1
Seeking	17.8	12.5	9.0	15.9	20.6	29.3	17.6	11.0
Study	3.4	4.8	1.3	7.2	3.5	2.2	1.0	0.5
Employment	14.4	7.6	7.7	8.7	17.2	27.1	16.6	10.4

*Details may not add to 100% because of rounding.

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

Table 2.13

RECENT DOCTORATE RECIPIENTS

Field Selection of Minority Ph.D.s, 1975 and 1985 (U.S. Citizens)

	Total U.S.		Asians		Blacks		Hispanics	
	1975	1985	1975	1985	1975	1985	1975	1985
Physical Sciences	13.4	13.0	17.5	19.4	4.1	3.3	8.9	7.5
Engineering	6.3	5.4	21.3	17.5	1.1	2.1	5.0	2.9
Life Sciences	14.6	19.1	18.9	24.9	5.6	7.7	12.9	13.4
Social Sciences	19.0	19.5	12.6	12.0	15.3	19.1	18.5	21.6
Humanities	16.4	12.2	10.5	8.3	8.7	7.3	21.1	17.2
Education	25.4	25.0	13.6	13.4	61.0	52.3	30.4	32.2
Professional Fields	4.9	5.8	5.6	4.5	4.2	8.1	3.3	5.2
Total*	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Details may not add to 100% because of rounding.

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

Table 2.14

RECENT DOCTORATE RECIPIENTS

Country of Citizenship of Non-U.S. Recipients, 1960-1985

	Year of Doctorate					
Country of Citizenship	1960	1965	1970	1975	1980	1985
Total, Non-U.S.	1176	2313	4148	5250	4934	6534
Canada	162	270	533	482	300	286
Mexico/Central America	15	27	41	75	85	149
Cuba and Islands	1	21	47	56	42	52
South America	21	44	189	290	348	340
Europe, Northern	50	119	289	259	198	230
Europe, Central	32	51	122	102	78	145
Europe, Eastern	26	41	88	85	100	134
Europe, Western	21	62	137	183	125	178
Africa, West North	0	2	6	172	226	367
Africa, East North	20	138	145	93	203	259
Africa, South	0	0	1	72	97	127
Africa, Unknown	14	57	134	0	0	0
Asia, Eastern	147	387	928	1143	1025	1847
Asia, Western	201	611	1092	1192	1125	1502
Australasia	55	107	220	217	186	223
Country Unknown	411	376	176	829	796	695

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

Table 2.15

RECENT DOCTORATE RECIPIENTS

Median Years to Degree, by Field, Sex, and Minority Status, 1985 (U.S. Citizens)

	Total All Fields	Field: Physical Sciences	Physics/ Astron.	Chemistry	Math	Field: Engi-neering	Field: Life Sciences	Biolog. Sciences	Health Sciences	Agric. Sciences
All U.S.	10.5	6.8	7.1	6.0	7.2	7.5	8.1	7.7	12.5	8.0
Men	9.6	6.8	7.1	6.0	7.2	7.6	7.8	7.6	10.9	8.0
Women	12.3	6.8	7.1	6.0	7.1	6.4	9.0	8.1	13.5	8.1
Asians	9.7	7.4	8.5	7.1	8.0	7.9	8.2	7.7	13.5	*
Men	9.4	7.5	9.0	7.3	8.0	8.3	7.9	7.6	*	*
Women	10.6	7.1	*	6.9	*	5.5	8.4	7.9	*	*
Blacks	14.4	8.5	*	6.8	*	8.8	9.3	8.8	14.0	*
Men	13.5	10.0	*	7.8	*	8.5	8.9	8.5	*	*
Women	15.0	*	*	*	*	*	11.0	9.0	14.5	*
Hispanics	11.8	7.2	7.0	6.0	*	8.2	8.0	7.6	14.0	8.0
Men	10.9	7.2	6.3	6.3	*	8.2	7.8	7.4	*	*
Women	12.3	7.0	*	*	*	*	8.2	7.8	*	*
Whites	10.4	6.7	7.1	5.9	7.2	7.5	8.1	7.7	12.5	7.9
Men	9.5	6.7	7.1	5.9	7.2	7.6	7.7	7.5	10.9	7.9
Women	12.1	6.8	7.1	5.9	7.2	6.5	9.1	8.2	13.5	7.9

Source: National Research Council, Summary Report 1985, Doctorate Recipients from U.S. Universities.

CHAPTER III

DEMOGRAPHY OF WOMEN AND MINORITIES

CHAPTER III - WOMEN AND MINORITIES: The Changing Population

Summary of Findings

The professions of the sciences and engineering have been the preserve of white males for a long period of time although women and minorities have been entering the professions in large numbers during the past ten years.

Racial/ethnic groups are distinguishable by certain educational profiles, such as field selection and post graduation plans. It is important, however, to note that these profiles do not, necessarily, describe the women of these groups.

In 1983, women constituted about 13% of all employed scientists and engineers, compared to about 44% of all employed persons and 48% of all those in professional occupations. This underrepresentation in science persists despite significant employment gains over the 1973-83 period, when employment of women scientists and engineers grew by 120% as compared with 42% increase for men.

Minorities have also made substantial gains in employment in science and engineering; however, underrepresentation persists with them as in the case of women.

Blacks, Asians, Native Americans and Hispanics differ in representation among scientists and engineers as well as representation in the general population's employment characteristics. Blacks constituted only 2.4% (83,000) of all employed scientists and engineers (S/E) in 1983, although they accounted for 9% of the total U.S. employment and 6% of all employed professionals. However, over the 1976-83 period, employment of black scientists and engineers increased more than twice as rapidly as the employment of white S/E. The employment of Asians increased less rapidly, 36% for the same period. The representation of American Indians among S/E was roughly equal to that in the total U.S. labor force: 0.4% (13,500) of all scientists and engineers and about 0.5% of the total labor force. Hispanics in 1983 were about 2% of all employed S/E and about 5% of all employed persons. At the doctoral level their field distribution was similar to that for all doctoral S/E.

At the doctoral level, employment of Blacks, Asians, and native Americans increased more rapidly than that of whites. For the same time frame, black PhDs more than doubled (from 2000 to 4900) and that of Asian PhDs tripled (to about 30,000). Among whites, doctoral employment increased 62% (from 202,200 to 328,500). More recently (1981-83), employment of both black and Asian doctorates grew, 17% and 9% respectively, which was greater than that of whites at 6%.

Across all races, over one half of all employed S/E in 1983 were engineers. The rate ranged from more than three-fifths among Asians to barely two-fifths among Blacks.

The importance of the demography of these subsets lies in the fact that they are growing. The influx of women and members of minority groups is expected to continue while white men will continue to be a decreasing fraction of the profession.

WOMEN CHEMISTS 1985

Nina M. Roscher

GENERAL DEMOGRAPHIC ASPECTS

AGE. The age distribution of women working as chemists at all degree levels is very different from that of men. The differences are greatest for BS chemists and reflect generally the increasing proportion of degrees granted to women in recent years. A corresponding shift has occurred among holders of advanced degrees, but that shift is not so dramatic. The difference between women's and men's age distribution is a reflection of two factors: the decrease in the number of men obtaining chemistry degrees at all levels over the last decade and an increase in the number of women obtaining degrees at all levels. Fifty percent of the women at the BS level are less than 30 years old, whereas only 21% of the men are less than 30 years old. One-fourth of the men but only 6% of the women at the BS level are older than 55.

FULL-TIME EMPLOYMENT. Among women chemists the fraction not employed but seeking work is greater than it is among men: 3.5% compared with 2.6%. At the BS level, however, the figures are comparable, 4.0% for men and 3.9% for women. At the doctoral level, the percent of women (3.4%) seeking work is twice that of men (1.7%). The percent of women (7.0%) occupying post-doctoral positions is twice as great as the percent of men (3.0%) occupying similar positions.

Among the more than 1000 respondents who were working part-time, a third of the men and 23% of the women were working part-time because full-time work was not available. Among this group, 38% of the men and 27% of the women were working part-time because that was what they preferred. A third of the women and 3% of the men gave constraints due to family or marital status as their reason for working part-time.

WORK SPECIALTY. A larger fraction of women than of men work in biochemistry, in pharmaceutical chemistry, and in clinical chemistry; a smaller fraction of women than of men work in chemical engineering and in polymer chemistry.

TYPE OF EMPLOYER. Women working for non-academic employers are less likely than men to be in the chemical industry, in coatings, and in the rubber industry, and are more likely to be employed in the various branches of government, non- profit research institutions, and the pharmaceutical industry.

MARITAL STATUS. In 1985, 17% of the male respondents were not currently married, as compared with 40% of the women. Married women (35%) are twice as likely to be married to a chemist or another scientist than are married men (17%). Married men were much less likely to be unemployed than were unmarried men, but the rate of unemployment for married women was twice that of unmarried women.

Source: Women Chemists 1985. American Chemical Society.

GEOGRAPHY. The ratio of women's to men's salaries does not differ greatly from one region to another, though generally women's salaries are closest to men's salaries in the northeast and in large metropolitan areas.

CHEMISTS IN NON-ACADEMIC AREAS

WORK FUNCTION. Non-academic women chemists are approximately one-third as likely as men to be in the management of research and development. At the BS level, 10% of the men and only 4% of the women are in R&D Management, whereas at the doctoral level, 24% of the men and 12% of the women are in this work area. The relative distribution of men and women is fairly comparable in applied research, quality control, and data processing. Although the percent of men in marketing is still more than that of women, the percent of women in marketing has increaased over the last five years and the percent of men has decreased.

At any degree level for men or women, the average salary is higher for those with supervisory responsibility. For BS non-supervisory chemists, the salary levels are the same for the first few years after the BS. The difference between men's and women's salaries begins to widen after about five years. With supervisory responsibilities, the salary is always greater for the BS men chemists than for the BS women chemists. Particularly among BS chemists, the percent of women who are in supervisory positions is considerably less than the percent of men with the same level of experience. Because supervision is generally one criterion signifying career progress, the data suggest that women do not progress as fast as men do.

WORK SPECIALTY. Type of employer is a very important consideration for non-academic salaries at any degree level. At the BS level, women generally earn less than men at all levels of experience and with all types of employers. In the federal government, women's salaries are probably closest to men's salaries. Many BS chemists work in the chemical industry, and in that industry, differences between men's and women's salaries are substantial across the entire span of the career. For MS chemists, the picture is much the same although the biggest overall salary difference is in the petroleum industry: the mean salary for women is only 72% of men's. At the PhD level, the salaries for women are generally less. Among all non-academic employers, the federal government is the best for women.

Among various specialties, the greatest differences between women's and men's salaries at the BS level are generally in organic and polymer chemistry. The differences are not as great in medicinal/clinical, environmental, and non-chemical specialties. At the MS level, the women's salaries in pharmaceutical and environmental specialties are closer to those of men than in other fields. At the PhD level, the best specialty for women in terms of salary differential is analytical chemistry.

CHEMISTS IN ACADEMIA

TENURE. Women in academic institutions are less likely to be tenured. Combining professors, associate professors, and assistant professors who hold the PhD and have positions in PhD, MS, and BS granting universities, 65% of the women and 80% of the men hold tenure.

RANK. Among all academic PhD chemists in 1985, 14% of the men and 23% of the women held the rank of assistant professor; 4% of men and 12% of women were instructors.

SALARY. In BS-granting institutions, women's mean salary expressed as a percent of men's is 96% for professors, 97% for associate professors, 100% for assistant professors, and 85% for instructors. In MS-granting institutions, women and men earn about the same salary at all ranks. Although this equality is encouraging, its importance is limited because the total faculty in this group is only 12% of those employed in academic institutions. In PhD-granting institutions, the mean salary for women is 89%, 86.7%, 93.8%, and 88.6% that for men respectively for professors through instructors. Generally, at all ranks and at all levels of experience, women earn less than men do. Women's salaries are generally comparable to men's, however, in PhD-granting instititutions at the assistant professor level, if level of experience is considered.

TIME ALLOCATIONS. Women professors spend their time much differently than men do. Nearly half of the women chemists (45%) spend at least three-fourths of their time teaching, whereas only one-third of men chemists do. About 10% of women and 8% of men spend at least three-quarters of their time on administration. A majority of the faculty spend less than one-third of their time on research: 60% of women and 53% of men. The major summer activity for the faculty is research. Two-thirds of the men teach or do funded research in the summer, compared to 55% of the women.

PERCEPTION.

FAIR PAY. Generally, women with more than five years experience are more likely than men to feel that they are not paid fairly. Among young chemists with less than five years experience, however, many more men than women see themselves as unfairly paid.

PROFESSIONAL ADVANCEMENT. Generally men agree or strongly agree with the statement that their chances for professional advancement as a scientist within their company or organization are as good as those of other employees with equivalent qualifications and experience. Older women see less opportunity than do younger women. There is no corresponding decline among older men.

MANAGERIAL ADVANCEMENT. The opportunities for managerial advancement are perceived quite differently by men and women. Among those with only one year of experience, more women than men see opportunities for advancement. Among those with two to five years experience, this expectation has declined to 55% of women and among those with thirty-five years experience to 35%.

JOB SATISFACTION. Generally, among full-time employed non-academic chemists at all levels of experience, men are more likely than women to agree wth the statement about job satisfaction. For both men and women, however, job satisfaction is high. Overall, 82% of women and 77% of men either agree or strongly agree with the statement.

JOB SECURITY. Job security for both men and women depends on age. For both men and women, chemists with 20-24 years experience have the lowest percent in strong agreement with the statement on job security. The strongest agreement is among those with no experience. No consistent pattern emerges in the number of men and women who disagree or strongly disagree with the statement that their job is secure for the next five years.

CONCLUSION.

Characteristics of both academic and non-academic chemists have changed substantially since the 1980 survey. Women's salaries generally have improved relative to men's. The demographic data suggest that ACS membership is changing and, that women are working in larger numbers and in more areas than they did five and ten years ago. The status of academic chemists, both men and women, has changed dramatically in the last five years.

BLACK CHEMISTS IN THE UNITED STATES

by

John Robert Jones, Herman A. Young, and Joan S. Burrelli

Blacks are a small fraction of the chemical profession and an even smaller fraction of the American Chemical Society. About 10% of the U.S. labor force, Blacks account for only 3% of employed chemists and only 1.1% of employed ACS member chemists.

For many years, the ACS has sent questionnaires to a sample of U.S. members who are neither students nor retired. In 1985, to obtain a finer statistical breakdown of its membership, the ACS expanded the survey, sending questionnaires to all persons in the target population. A particular goal was to obtain a statistical profile of ACS chemists who belong to various ethnic and racial minority groups. This article is a summary of results concerning black members of the ACS.

Statistics derived from the ACS survey do not represent Blacks so well as they represent other racial groups because Blacks are less likely than others to be ACS members. One reason for Blacks' underrepresentation in the ACS is that BS chemists are much less likely to join the ACS than are PhDs, and a relatively small fraction of Blacks hold the doctorate. ACS statistics probably serve well to represent black PhD chemists. Where BS and MS chemists are concerned, however, those Blacks who belong to the ACS may differ from those who do not belong. Thus, statistics based on ACS membership may not tell a definitive story about BS and MS black chemists.

Although the overwhelming majority of black ACS members were born in the U.S., the black immigration of the past two decades has had a decided effect on the chemical profession. Among black respondents, 86% are U.S. natives. That fraction is neither the smallest nor the largest among the various racial and ethnic groups. A larger fraction of whites (93%) and of American Indians (100%) are natives of the United States. In contrast, far smaller fractions of Hispanics (60%) and of Asians (16%) were born in the United States.

Women are 25% of black members but only 15% of white members. The relatively large number of women among Blacks does not mean that a large fraction of black women, as compared with white women, go into chemistry. The relatively large fraction of women among black ACS members is a result of the fact that only a tiny fraction of black men study chemistry and enter the profession. (This article generally uses statistics about whites to give some standard for interpreting the Black figures. Some comparison is necessary to give the black numbers some background, but such comparison does not imply that the white figures are necessarily appropriate goals for Blacks.)

A very large fraction of black women are unmarried-- 54%, as compared with 40% of white women. Among men, 24% of black and 17% of white respondents are unmarried.

An unusual result available from the 1985 survey is the fraction of respondents married to chemists and the fraction married to scientists.

Among married black women 13% are married to chemists and 31% are married to scientists. Among married white women, 30% are married to chemists and 58% are married to scientists. Men follow the same pattern. Among married black men, 2% have wives who are chemists and 14% have wives who are scientists. Among married white men, 9% are married to chemists and 20% to scientists.

Black ACS members are younger, on average, than are white members. Whereas 47% of Blacks are less than 40 years old, only 43% of whites are so young. Black ACS members are less likely than whites to hold PhDs (42% as compared with 53%).

Geographically, black ACS members are far more concentrated than whites are in the South Atlantic states (34% of Blacks as compared with 17% of whites), and are somewhat less concentrated in the Pacific states, the mountain states, and the Mid-West.

The races are distributed differently among subfields of chemistry, both among subfields in which ACS members received their degrees and among the subfields in which they work. The field where Blacks have the greatest concentration as compared with non-blacks is analytical chemistry. Among PhDs 12% of Blacks and 9% of whites earned their doctorate in analytical chemistry. The distribution among specialties in which PhDs work also shows Blacks relatively concentrated in analytical chemistry. Of black PhDs, 19% work in analytical chemistry, although only 12% of white PhDs in the ACS work in that subfield. Biochemistry is another subfield in which Blacks are somewhat more concentrated than non-blacks are. Subfields in which black PhDs are somewhat less concentrated in comparison with other races include organic chemistry, agricultural and food chemistry, and physical chemistry.

The unemployment rate seems to be about the same among Blacks as among whites. Although a smaller fraction of black respondents than of white respondents were unemployed, the difference in the sample results is not large. That small difference could be a mere statistical artifact that would not have occurred if the sample had included more Blacks. In early 1985, about two and one-half percent (2.5%) both of black and of white ACS members were unemployed. Races other than Blacks and whites uniformly experienced rates of unemployment greater than 3%.

Government work attracts a disproportionate share of black chemists. Of ACS members employed full-time in non-academic positions, 22% of Blacks and 12% of whites work for various levels of government. Both at the federal level and at the state and local level, governments employ a fraction of non-academic Blacks one and one-half times that of whites. The federal government employs 18% of non-academic Blacks but only 12% of whites. State and local governments employ four and one-half percent of Blacks and 3% of whites. Although one might expect that statistics would show not-for-profit organizations to be similar to government, when it comes to employment of black chemists the two types of employers contrast sharply. The likelihood that an ACS member will work in a not-for-profit organization is about one-fourth as great for Blacks as for whites.

Those black ACS members who do work in private industry seem to favor the pharmaceuticals and personal care industry. Of respondents who work in private industry, about 22% of Blacks, but only 17% of whites, work for companies that manufacture pharmaceuticals or personal care products.

Blacks also have a much greater tendency to work for companies that manufacture products other than the more common ones. Among ACS members employed in private industry, 21% of Blacks, but only 16% of whites, work for companies whose products did not make the list of products presented on the questionnaire.

The distribution among work functions presents some striking contrasts. Among ACS members who work full-time for non-academic employers, Blacks are less likely than whites to work as managers of research and development but are more likely than whites to work in other management positions. In comparison with whites, Blacks are more likely to work in basic research but are less likely to work in development and applied research. Blacks are underrepresented in marketing but overrepresented in production and quality control. A smaller fraction of Blacks than of whites are in consulting, and a larger fraction are in those work functions not common enough to be on the check-off list that appeared on the questionnaire.

In the academic world also, statistics show some contrasts between Blacks and whites. A larger fraction of Blacks than of whites are unranked, either because their institutions do not use ranks or because they are in jobs that do not carry rank. Among those who have titles that do designate rank, the distribution among full-professors, associate professors, and instructors is very similar for Blacks and for whites. Blacks, however, are more likely than whites to be assistant professors and less likely than whites to be research associates. The survey results do not show any difference in the fraction of Blacks and of whites in tenure-track positions: about 70% of each group.

The type of school in which ACS members work differs with race. A larger fraction of Blacks than of whites work in medical schools. Schools that offer the master's degree as the highest degree employ a larger fraction of Blacks, and doctoral institutions employ a larger fraction of whites. Results of the survey do not show any difference between the fractions of Blacks and of whites employed in high schools or two-year colleges.

The distribution among the primary work functions shows that Blacks are probably slightly more likely to be in teaching. The real difference between the work functions of Blacks and whites, however, concerns research and administration. Blacks are more likely than whites to be in administration and less likely to be in university research.

Salaries of black chemists are smaller than those of whites. For example, among PhD chemists employed full-time by non-academic employers, half the Blacks earned $45,100 or less in 1985 while half the whites earned at least $49,200. That is to say that the median salary of Blacks was 8.3% less than the median salary of whites. The difference between Blacks' and whites' salaries could result from a variety of causes that include amount of experience, job assignments, and type of employer--as well as old-fashioned salary discrimination.

If Blacks were younger on average than whites, then the difference in salaries might result partly from the fact that younger chemists earn less than their older colleagues do. The statistical method that employees a standard population to compare the salary structure, however, indicates that a different distribution according to age or experience does not account for the difference in average salaries. Whether the differences in the job functions to which Blacks and whites are assigned would account for the salary differences is for now still an open question.

Another possible explanation is that black PhDs are less likely than whites to have obtained the doctorate while they were still young. Being older when they obtained the doctorate would mean having smaller salaries at any specific age because employers of PhDs value experience after the doctorate more than that before the doctorate.

A word about discrimination. Analysts often distinguish between salary discrimination and other forms of discrimination that might affect the relation between salary and age. In general, most observers would be surprised to find widespread and pronounced discrepancies between salaries of Blacks and those of comparable professionals in the same jobs. If such differences did exist, then they would amount to salary discrimination. But other kinds of discrimination can also lead to discrepancies in salaries. In particular, if employers were reluctant to place Blacks in the well-paying work functions, or in the well-paying work specialties, then Blacks would receive lower salaries even if Blacks and whites made the same salaries in every specific work function and specialty.

Unfortunately, the numbers of Blacks in the data set are insufficient to allow tabular analysis, which is the basis of this article, to determine whether such discrimination might contribute to Blacks' smaller salaries.

One difficulty that no statistical methods are likely to overcome is that a smaller fraction of Blacks than of others are included in the data set. No doubt Blacks who join the ACS are, on average, better paid than those who do not join. If only the better-paid Blacks join the ACS, then even equality of Blacks' and whites' salaries among ACS members would tell nothing about the Black/white salary ratio among those who do not belong to the Society. Developing the data needed to monitor the progress of Blacks in chemistry and chemical engineering depends on developing a much more inclusive sampling frame. Such a sampling frame would allow for a more representative sample of Blacks in the profession. NOBCChE may well be the only organization equipped to shoulder that responsibility. When a more representative list becomes available, the American Chemical Society will offer whatever technical assistance may be needed to collect and analyze information about Blacks in the U.S. chemical profession.

ASIANS IN THE U.S. CHEMICAL PROFESSION

by John Robert Jones

Two striking developments force students of scientific manpower to devote special attention to scientists of Asian origin. First, although Asians now comprise only about 2% of the U.S. workforce, Asians have been and by all estimates will continue to be an increasingly large part of the U. S. population. Since Lyndon Johnson's administration, when the U. S. eliminated the "Hindu exclusion" and the Chinese exclusion, immigration from South Asia and from East Asia has been rapid and continuous. Second, Asians, who often enter the U. S. as graduate students and then find ways to stay on, are far more educated than non-Asians in the U. S. and are far more likely than others, even other educated workers, to pursue scientific careers. This growth of the Asian-American population and that population's leaning toward science combine to place novel responsibilities on the scientific community.

One aspect of that responsibility concerns possible prejudices that could unfairly hamper some members of the profession. Racial, national, and linguistic prejudices are real difficulties even among those whose training and temperament lead them to take pride in their cold rationality. Furthermore, those who have worked hardest to promote fairness suffer a certain conflict when they see foreigners receive honors that otherwise might have gone to native women and to native members of racial or ethnic minorities.

Asians already in the profession are shouldering responsibility for helping the profession make the necessary adjustments. Two large groups organized for this purpose are the Indian Chemists Club and the Chinese American Chemical Society, both of which have chosen to associate themselves closely with the American Chemical Society.

This article does not propose solutions to problems or even say specifically what is desirable. Instead, it gives statistics that may prove useful to the American Chemical Society and other groups that seek to understand how the profession is evolving. This analysis should help those who plan programs that will guide the profession's adaptation to its changing milieu. Statistics about the forces at work on the profession should encourage and promote adjustments that will make the profession more effective by providing its practitioners the opportunity for more satisfying and rewarding careers.

Asian-Americans show their collective good taste not only by favoring technical subjects when they choose careers, but by specifically leaning toward chemistry as their life work. Not only are they three times as likely as others to choose science or engineering, but they also choose chemistry in numbers out of proportion to their presence in the science and engineering population. The 1980 census found that 1.6% of the U. S. population was of Asian origin. The NSF found that Asians were 4.6% of the science and engineering population. Asians are an even greater fraction of chemists: in 1985, 5.8% of chemists in the American Chemical Society were of Asian origin.

Furthermore, Asians are an increasing proportion of the chemical profession: in the past eight years they have gone from being a little less than 5% of ACS members to just a little less than 6%.

The only source of detailed statistics about Asians in chemistry is the 1985 survey of ACS members. The rest of this article is an analysis of the results of that survey. For convenience the term "chemists" will refer to chemists who in 1985 were not students, were not retired, and were members of the American Chemical Society. Furthermore, the rest of this article uses the present tense to describe the conditions that prevailed at the time of the 1985 survey.

About 16% of chemists of Asian races are U.S. natives and about 5% hold temporary visas. The rest are either non-citizen, permanent residents or are naturalized citizens. The table below shows that the distribution by citizenship varies markedly among Asian races. Two points deserve special note. First, although the overwhelming majority of Japanese are U.S. natives, a larger fraction of Japanese than of other Asian races hold temporary visas. About 24% of non-native Japanese hold temporary visas, whereas among the non-Japanese Asian races only about 5% of non-citizens hold temporary visas. Apparently Japanese who come to the U.S. are far less likely to remain permanently. The second striking point is that fewer than one-half of one percent of Indians are natives of the U.S. Incidently, in this article the words "Chinese" and "Indians" describe races, not nationalities. Thus, a "Chinese" immigrant could be from Hong Kong, Taiwan, Singapore, any of the various countries in Southeast Asia or other countries in which Chinese are a minority. Similarly "Indians" are persons from India, Pakistan, Bangladesh, Ceylon and other subcontinental countries as well as Malaysia, Gayana, Jamaica, and other countries where Indians are a minority. The group sometimes labeled "Other Asians", and sometimes Southeast Asians, is probably mostly Filipinos.

CITIZENSHIP

U.S. Residents

	Natives	Naturalized	Permanent Residents	Temporary Visa Holders
Whites	93	5	2	0
Japanese	67	12	13	8
Koreans	20	66	13	2
Chinese	13	61	22	4
Southeast Asians	6	57	33	4
Subcontinental Indians	0	47	47	6

The next table, which shows the sex distribution according to race, defies generalization. A very small fraction of Indians, who are virtually all immigrants, are women. On the other hand, the group of which women are the greatest fraction is "Other Asians," 97% of whom are immigrants.

WOMEN AS A PERCENT OF RACE

Other Asians	26%
Chinese	20%
Whites	15%
Japanese	14%
Koreans	12%
Indians	7%

The degrees held by the members of the various Asian races do show some relationship to national origin. The next table shows that Japanese, who are mostly U. S. natives, resemble whites in that a relatively small fraction of them hold the doctorate. The pattern, however, does not apply to the group labeled "Other Asians." Although only 4% of the members of this group are U.S. natives, hardly any more of them than of whites hold the doctorate. To some extent Southeast Asians' abundance of women may explain their relative lack of doctoral degrees. Among all racial groups, women are far less likely than men to hold the highest degree. "Other Asians" aside, the great number of doctorates among Asians may have to do with immigration. Some persons who ostensibly enter the United States in order to study, in fact, do quite the opposite: They go to graduate school as a means of entering the United States. Further, because U.S. employers have great difficulty evaluating foreign degrees, many immigrants who obtained their first degree abroad feel pressure to obtain U.S. credentials. This pressure may cause an "over-credentialing" among some immigrants who would be perfectly content to work without advanced degrees if their foreign credentials could receive full value.

PhDs AS A PERCENT OF RACE

Indians	83%
Chinese	75%
Koreans	74%
Japanese	62%
Other Asians	55%
Whites	53%

This American skittishness about foreign degrees is not entirely unfounded and does not apply equally to degrees from all countries. In particular, Indian degrees are usually evaluated as less than the corresponding degree from the United States and Indians may therefore be subject to especially strong need to obtain U.S. credentials. Unfortunately, the data set does not distinguish between degrees earned in the United States and those earned abroad; nor does it distinguish those U.S. degrees earned at more prestigious universities from those earned at less prestigious ones.

The following table shows something about the kinds of institutions in which PhD academic chemists work. The message seems to be that Chinese and northeast Asians will work in academic institutions if they can land jobs at prestigious institutions, whereas Indians and Southeast Asians seem to go for the professorial life wherever they can find it.

CHEMISTS WORKING IN DOCTORAL INSTITUTIONS
AS A PERCENT OF CHEMISTS WORKING FULL-TIME IN
ALL ACADEMIC INSTITUTIONS

Koreans	64%
Japanese	59%
Chinese	53%
Whites	43%
Indians	30%
Other Asians	30%

The following table concerns where chemists live in the U.S. Just as native-born Japanese and Chinese are heavily concentrated in the Pacific area, immigrants of these races also favor the Pacific. In contrast, Indians seem to favor other parts of the country.

CONCENTRATION IN THE PACIFIC STATES (AK, CA, HI, OR, WA)
according to RACE and NATIONAL ORIGIN

	Non-U.S. Natives	U.S. Natives
Japanese	22%	50%
Chinese	21%	42%
Koreans	20%	
Whites	15%	12%
Other Asians	14%	
Indians	8%	

The age distribution of the various races is closely related to national origin and highest degree. About 10% of whites, and of Japanese, and nearly that large a percent of the Southeast Asians are less than 30 years old. These races tend to get out and work while they are still young rather than stay in school to get advanced degrees. The somewhat smaller fraction less than 30 years old among Southeast Asians than among whites and Japanese is probably related to the fact that the Southeast Asians are mostly immigrants, whereas the whites and Japanese are mostly natives. A very small fraction of Indians and Chinese are less than 30 years old.

In comparison with whites, very few of the Indians, Chinese, or Southeast Asians are more than 45 years old. This relative absence of chemists in middle age is no doubt a result of the patterns of immigration: persons in their twenties come to this country and have been doing so for only about 20 years.

The various Asian races tend toward different specialties, and no doubt part of those differences could be attributed to differing statistical characteristics of the racial groups. The choice of specialty is influenced by the chemist's sex, age, national origin, and region where the chemist lives in the United States. Such differences, however, are probably inadequate to account for the striking differences in how the various races are distributed among chemical specialties. Consider for example, chemical engineers as a fraction of PhDs. Whereas a very large fraction of Chinese and Indian PhDs in the ACS are chemical engineers, hardly any Japanese PhDs in the ACS are engineers. Biochemistry attracts PhDs of all races in about the same proportions-- except for Japanese, who are heavily concentrated in that specialty. Analytical chemistry attracts relatively few Japanese but seems to be a favorite among those of Southeast Asian origin. Chinese, Korean, and Southeast Asian PhDs are heavily concentrated in polymer chemistry. Medicinal and clinical chemistry are favorites of Indian, Southeast Asian, and especially Japanese PhDs. Agricultural and food chemistry attract Chinese, Southeast Asian, and especially Japanese PhDs.

Let us turn now to what kind of work chemists perform. Clearly, race bears a very strong relationship to the probability that a chemist works as a manager. The table below shows that all Asian races are underrepresented in management, but that this underrepresentation is much more pronounced among Chinese and less so among Southeast Asians.

CONCENTRATION IN MANAGEMENT AMONG PhD CHEMISTS EMPLOYED FULL-TIME BY NON-ACADEMIC EMPLOYERS

Whites	29%
"Other Asians"	19%
Japanese	13%
Subcontinental Indian	11%
Chinese	6%

Except for Japanese, who seem to favor government jobs, the Asian races are distributed among government, private industry and academia pretty much as whites are. Unemployment is somewhat more severe among Indians and Southeast Asians, but about normal for other Asian races.

We now turn to salaries. To confine attention to comparable groups, we consider only PhD chemists working in non-academic positions. Column two of the table below shows mean salaries according to race. Column 3 contains salaries that have been made comparable by using a standard population to remove salary differences that may result from differences in age distribution among the races. Koreans and Southeast Asians are left out of column 3 because too few data are available to allow using this method of analysis. The results show that Chinese and Japanese receive salaries about 7% less than expected, and Indians about 15% less.

SALARIES OF NON-ACADEMIC PhD CHEMISTS

	NUMBER OF RESPONDENTS	UN-ADJUSTED	ADJUSTED IN CONSIDERATION OF AGE DISTRIBUTION	
		Dollars	Dollars	(Index Whites=100)
Whites	10,201	51,654	50,845	100.0
Chinese	518	46,115	47,008	92.5
Japanese	88	50,416	47,558	93.5
Korean	51	50,416		
Subcontinental Indian	227	43,643	43,107	84.8
Other Asians	109	43,087		

Even using a standard population, tabular analysis cannot proceed to further refinement because the number of data that refer to Asian chemists is insufficient. A method that gets around the requirement for massive numbers of data is regression analysis that uses dummy variables to represent categories of the variables that explain or predict salary. A model that proved useful was one that regressed the logarithm of salary on dummy variables representing various categories of professional maturity, work functions, highest degrees, categories of citizenship, and race. Such models help to determine why Orientals seem to receive salaries smaller than do whites doing the same work and having the same qualifications. Because almost none of the South Asians (Indians) are U.S. natives, the regression considers only East Asians or Orientals (Japanese, Koreans, Chinese, and Southeast Asians).

A comparison of white and Oriental chemists shows that U.S.-born Orientals do not earn significantly less than do U.S.-born whites. Another regression, which compared Orientals with one another according to citizenship, established that the reason that Orientals earn so much less than whites has to do with citizenship. Naturalized citizens earn less than natives do, and permanent residents earn less than naturalized citizens do. The data seem to be consistent with the hypothesis that deficiencies in Orientals' salaries tend to disappear when they become thoroughly familiar with the language and the culture.

The 1985 survey of ACS members asked several questions about chemists' attitudes toward their work and about how they perceived their career opportunities. The responses to the ACS salary questionnaire (an excerpt of which follows) varied markedly amomg the races.

PLEASE EVALUATE THE FOLLOWING STATEMENTS AND INDICATE WHETHER YOU AGREE OR DISAGREE

[For each of the five questions, respondents checked one of five responses: strongly agree, agree, no opinion, disagree, strongly disagree.]

My employer pays me fairly in comparison with other employees who have similar duties and responsibilities.

My chances for PROFESSIONAL advancement as a scientist within my company or organization are as good as those of other employees with equivalent qualifications and experience.

My chances for MANAGERIAL or administrative advancement within my company or organization are as good as those of other employees with equivalent qualifications and experience.

Most of the time, I'm satisfied with my job.

I feel that my job is secure for the next five years.

The following five tables show that Japanese and Hispanics give answers similar to those that whites give. The reason may have to do with national origin. Whites, Japanese, and Hispanic chemists are mostly native-born citizens whereas Asian races other than Japanese are mostly immigrants. If that explanation is correct, then the children of today's immigrants from Asia may avoid many of the difficulties that their parents suffered. (As usual in these matters, the experience of Blacks is unique.)

My employer pays me fairly
[Percent of respondents who agree or strongly agree]

Whites	73%
Hispanics	71%
Japanese	66%
Koreans	60%
Subcontinental Indians	59%
Chinese	55%
Blacks	52%
Southeast Asians	51%

My chances for MANAGERIAL advancement are fair
[Percent of respondents who agree or strongly agree]

Whites	61%
Hispanic	56%
Japanese	50%
Blacks	42%
Subcontinental Indians	36%
Southeast Asians	36%
Koreans	34%
Chinese	31%

My job is secure
[Percent of respondents who agree or strongly agree]

Whites	70%
Koreans	70%
Hispanics	69%
Blacks	62%
Southeast Asians	61%
Chinese	60%
Subcontinental Indians	49%

My chances for PROFESSIONAL ADVANCEMENT are fair
[Percent of respondents who agree or strongly agree]

Whites	69%
Japanese	64%
Subcontinental Indians	57%
Koreans	56%
Blacks	51%
Chinese	50%
Southeast Asians	48%

My job is satisfying
[Percent of respondents who agree or strongly agree]

Whites	82%
Japanese	81%
Hispanics	80%
Blacks	77%
Subcontinental Indians	77%
Koreans	72%
Southeast Asians	72%
Chinese	71%

CONCLUSION

This study is only a beginning and does not attempt to provide definitive answers to the many questions that deserve attention. Results, nevertheless, are available. Some differences among the races seem to reflect cultural differences among groups-- at least among those Asian chemists who happen to live in the United States and be members of the ACS. Examples include choice of specialty and choice of employer. Salary statistics show that Asians do receive salaries somewhat smaller than whites do, but the data do not provide evidence that Asians' lower salaries are a result of unfair treatment.

Table 3.1

ALL RESPONDENTS
according to RACE/ETHNICITY and CITIZENSHIP
1986 Survey of ACS Members

	ETHNICITY								
CITIZENSHIP	Black	Hispanic	American Indian	Asian	White	Other Race	No Response	TOTAL	
U.S.	92	69	14	97	9,005	25	104	9,406	-Count
Native	1.0%	0.7%	0.1%	1.0%	95.7%	0.3%	1.1%	100.0%	-% of Row
	76.7%	60.0%	87.5%	15.8%	92.6%	41.7%	71.2%	87.1%	-% of Col
U.S.	7	30	0	338	461	18	11	865	
Naturalized	0.8%	3.5%	0.0%	39.1%	53.3%	2.1%	1.3%	100.0%	
	5.8%	26.1%	0.0%	55.0%	4.7%	30.0%	7.5%	8.0%	
U.S.	9	12	0	138	205	15	6	385	
Permanent Visa	2.3%	3.1%	0.0%	35.8%	53.2%	3.9%	1.6%	100.0%	
	7.5%	10.4%	0.0%	22.5%	2.1%	25.0%	4.1%	3.6%	
Other Visa	0	1	1	38	39	2	1	82	
	0.0%	1.2%	1.2%	46.3%	47.6%	2.4%	1.2%	100.0%	
	0.0%	0.9%	6.3%	6.2%	0.4%	3.3%	0.7%	0.8%	
No Response	12	3	1	3	14	0	24	57	
	21.1%	5.3%	1.8%	5.3%	24.6%	0.0%	42.1%	100.0%	
	10.0%	2.6%	6.3%	0.5%	0.1%	0.0%	16.4%	0.5%	
TOTAL	120	115	16	614	9,724	60	146	10,795	
	1.1%	1.1%	0.1%	5.7%	90.1%	0.6%	1.4%	100.0%	
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Table 3.2

ALL RESPONDENTS
according to LOCAL SECTION and AGE LEVEL
1986 Survey of ACS Members

	AGE LEVEL													
LOCAL SECTION	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70	No Response	TOTAL	
Orange Cty	7	16	26	32	31	17	15	18	14	6	0	3	185	-Count
	3.8%	8.6%	14.1%	17.3%	16.8%	9.2%	8.1%	9.7%	7.6%	3.2%	0.0%	1.6%	100.0%	-% of Row
	3.3%	1.5%	1.6%	2.0%	1.6%	1.8%	1.4%	1.5%	1.9%	2.3%	0.0%	2.0%	1.7%	-% of Col
Santa Clara	3	29	37	44	43	20	13	14	15	5	0	5	228	
	1.3%	12.7%	16.2%	19.3%	18.9%	8.8%	5.7%	6.1%	6.6%	2.2%	0.0%	2.2%	100.0%	
	1.4%	2.7%	2.2%	2.8%	2.3%	2.1%	1.2%	1.2%	2.0%	1.9%	0.0%	3.4%	2.1%	
Southern California	5	32	49	35	38	24	25	24	17	9	0	1	259	
	1.9%	12.4%	18.9%	13.5%	14.7%	9.3%	9.7%	9.3%	6.6%	3.5%	0.0%	0.4%	100.0%	
	2.3%	2.9%	2.9%	2.2%	2.0%	2.5%	2.4%	2.0%	2.3%	3.5%	0.0%	0.7%	2.4%	
California	4	29	48	52	48	19	29	30	15	1	0	5	280	
	1.4%	10.4%	17.1%	18.6%	17.1%	6.8%	10.4%	10.7%	5.4%	0.4%	0.0%	1.8%	100.0%	
	1.9%	2.7%	2.9%	3.3%	2.5%	2.0%	2.7%	2.5%	2.0%	0.4%	0.0%	3.4%	2.6%	
Chicago	18	61	102	77	86	41	51	58	44	13	0	3	554	
	3.2%	11.0%	18.4%	13.9%	15.5%	7.4%	9.2%	10.5%	7.9%	2.3%	0.0%	0.5%	100.0%	
	8.4%	5.6%	6.1%	4.9%	4.6%	4.3%	4.8%	4.9%	5.9%	5.0%	0.0%	2.0%	5.1%	
Cleveland	11	17	27	19	22	10	10	19	8	3	0	3	149	
	7.4%	11.4%	18.1%	12.8%	14.8%	6.7%	6.7%	12.8%	5.4%	2.0%	0.0%	2.0%	100.0%	
	5.1%	1.6%	1.6%	1.2%	1.2%	1.0%	0.9%	1.6%	1.1%	1.2%	0.0%	2.0%	1.4%	
Minnesota	1	18	27	37	45	14	13	10	5	3	1	4	178	
	0.6%	10.1%	15.2%	20.8%	25.3%	7.9%	7.3%	5.6%	2.8%	1.7%	0.6%	2.2%	100.0%	
	0.5%	1.7%	1.6%	2.4%	2.4%	1.5%	1.2%	0.8%	0.7%	1.2%	14.3%	2.7%	1.6%	
New York	13	48	59	64	68	34	46	53	41	24	0	6	456	
	2.9%	10.5%	12.9%	14.0%	14.9%	7.5%	10.1%	11.6%	9.0%	5.3%	0.0%	1.3%	100.0%	
	6.0%	4.4%	3.5%	4.1%	3.6%	3.5%	4.3%	4.4%	5.5%	9.3%	0.0%	4.1%	4.2%	
Northeastern	26	67	110	90	89	45	51	69	49	9	0	2	607	
	4.3%	11.0%	18.1%	14.8%	14.7%	7.4%	8.4%	11.4%	8.1%	1.5%	0.0%	0.3%	100.0%	
	12.1%	6.2%	6.6%	5.7%	4.7%	4.7%	4.8%	5.8%	6.6%	3.5%	0.0%	1.4%	5.6%	
North Jersey	16	57	109	106	107	40	72	76	56	18	1	11	669	
	2.4%	8.5%	16.3%	15.8%	16.0%	6.0%	10.8%	11.4%	8.4%	2.7%	0.1%	1.6%	100.0%	
	7.4%	5.2%	6.5%	6.8%	5.7%	4.2%	6.8%	6.4%	7.6%	7.0%	14.3%	7.4%	6.2%	
Philadelphia	15	58	85	85	68	41	39	59	38	15	0	6	509	
	2.9%	11.4%	16.7%	16.7%	13.4%	8.1%	7.7%	11.6%	7.5%	2.9%	0.0%	1.2%	100.0%	
	7.0%	5.3%	5.1%	5.4%	3.6%	4.3%	3.7%	4.9%	5.1%	5.8%	0.0%	4.1%	4.7%	
Pittsburgh	1	15	30	21	30	13	19	21	19	3	1	2	175	
	0.6%	8.6%	17.1%	12.0%	17.1%	7.4%	10.9%	12.0%	10.9%	1.7%	0.6%	1.1%	100.0%	
	0.5%	1.4%	1.8%	1.3%	1.6%	1.4%	1.8%	1.8%	2.6%	1.2%	14.3%	1.4%	1.6%	
Southeastern Texas	6	37	48	46	37	26	22	34	8	5	0	5	274	
	2.2%	13.5%	17.5%	16.8%	13.5%	9.5%	8.0%	12.4%	2.9%	1.8%	0.0%	1.8%	100.0%	
	2.8%	3.4%	2.9%	2.9%	2.0%	2.7%	2.1%	2.8%	1.1%	1.9%	0.0%	3.4%	2.5%	
St. Louis	5	21	41	31	39	8	10	16	14	3	0	5	193	
	2.6%	10.9%	21.2%	16.1%	20.2%	4.1%	5.2%	8.3%	7.3%	1.6%	0.0%	2.6%	100.0%	
	2.3%	1.9%	2.5%	2.0%	2.1%	0.8%	0.9%	1.3%	1.9%	1.2%	0.0%	3.4%	1.8%	
Washington, D.C.	7	39	37	50	77	43	63	44	25	12	1	5	403	
	1.7%	9.7%	9.2%	12.4%	19.1%	10.7%	15.6%	10.9%	6.2%	3.0%	0.2%	1.2%	100.0%	
	3.3%	3.6%	2.2%	3.2%	4.1%	4.5%	5.9%	3.7%	3.4%	4.7%	14.3%	3.4%	3.7%	
Other Local Section	70	498	779	717	980	525	541	587	340	116	3	61	5,217	
	1.3%	9.5%	14.9%	13.7%	18.8%	10.1%	10.4%	11.3%	6.5%	2.2%	0.1%	1.2%	100.0%	
	32.6%	45.8%	46.6%	45.8%	52.0%	54.7%	51.0%	49.2%	45.9%	45.0%	42.9%	41.2%	48.3%	
No Response	7	46	59	61	77	40	41	61	33	13	0	21	459	
	1.5%	10.0%	12.9%	13.3%	16.8%	8.7%	8.9%	13.3%	7.2%	2.8%	0.0%	4.6%	100.0%	
	3.3%	4.2%	3.5%	3.9%	4.1%	4.2%	3.9%	5.1%	4.5%	5.0%	0.0%	14.2%	4.3%	
TOTAL	215	1,088	1,673	1,567	1,885	960	1,060	1,193	741	258	7	148	10,795	
	2.0%	10.1%	15.5%	14.5%	17.5%	8.9%	9.8%	11.1%	6.9%	2.4%	0.1%	1.4%	100.0%	
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Table 3.3

ALL RESPONDENTS
according to LOCAL SECTION and HIGHEST DEGREE
1986 Survey of ACS Members

HIGHEST DEGREE

LOCAL SECTION	Bachelors	Masters	Doctorate	No Response	TOTAL	
Orange Cty	44	41	98	2	185	-Count
	23.8%	22.2%	53.0%	1.1%	100.0%	-% of Row
	1.7%	2.0%	1.6%	2.1%	1.7%	-% of Col
Santa Clara	53	43	131	1	228	
	23.2%	18.9%	57.5%	0.4%	100.0%	
	2.0%	2.1%	2.2%	1.1%	2.1%	
Southern	69	67	121	2	259	
California	26.6%	25.9%	46.7%	0.8%	100.0%	
	2.6%	3.2%	2.0%	2.1%	2.4%	
California	62	44	167	7	280	
	22.1%	15.7%	59.6%	2.5%	100.0%	
	2.3%	2.1%	2.8%	7.4%	2.6%	
Chicago	161	96	294	3	554	
	29.1%	17.3%	53.1%	0.5%	100.0%	
	6.1%	4.6%	4.9%	3.2%	5.1%	
Cleveland	61	25	63	0	149	
	40.9%	16.8%	42.3%	0.0%	100.0%	
	2.3%	1.2%	1.1%	0.0%	1.4%	
Minnesota	39	32	106	1	178	
	21.9%	18.0%	59.6%	0.6%	100.0%	
	1.5%	1.5%	1.8%	1.1%	1.6%	
New York	102	105	238	11	456	
	22.4%	23.0%	52.2%	2.4%	100.0%	
	3.9%	5.0%	4.0%	11.6%	4.2%	
Northeastern	151	116	336	4	607	
	24.9%	19.1%	55.4%	0.7%	100.0%	
	5.7%	5.6%	5.6%	4.2%	5.6%	
North Jersey	168	151	346	4	669	
	25.1%	22.6%	51.7%	0.6%	100.0%	
	6.4%	7.2%	5.8%	4.2%	6.2%	
Philadelphia	145	96	264	4	509	
	28.5%	18.9%	51.9%	0.8%	100.0%	
	5.5%	4.6%	4.4%	4.2%	4.7%	
Pittsburgh	54	32	88	1	175	
	30.9%	18.3%	50.3%	0.6%	100.0%	
	2.0%	1.5%	1.5%	1.1%	1.6%	
Southeastern	83	47	141	3	274	
Texas	30.3%	17.2%	51.5%	1.1%	100.0%	
	3.1%	2.3%	2.4%	3.2%	2.5%	
St. Louis	45	45	101	2	193	
	23.3%	23.3%	52.3%	1.0%	100.0%	
	1.7%	2.2%	1.7%	2.1%	1.8%	
Washington, D.C.	77	60	264	2	403	
	19.1%	14.9%	65.5%	0.5%	100.0%	
	2.9%	2.9%	4.4%	2.1%	3.7%	
Other	1,223	993	2,970	31	5,217	
Local Section	23.4%	19.0%	56.9%	0.6%	100.0%	
	46.3%	47.6%	49.7%	32.6%	48.3%	
No Response	102	91	249	17	459	
	22.2%	19.8%	54.2%	3.7%	100.0%	
	3.9%	4.4%	4.2%	17.9%	4.3%	
TOTAL	2,639	2,084	5,977	95	10,795	
	24.4%	19.3%	55.4%	0.9%	100.0%	
	100.0%	100.0%	100.0%	100.0%	100.0%	

Table 3.4

ALL RESPONDENTS
according to SEX and HIGHEST DEGREE
1986 Survey of ACS Members

	HIGHEST DEGREE					
SEX	Bachelors	Masters	Doctorate	No Response	TOTAL	
Men	2,055	1,629	5,345	64	9,093	-Count
	22.6%	17.9%	58.8%	0.7%	100.0%	-% of Row
	77.9%	78.2%	89.4%	67.4%	84.2%	-% of Col
Women	581	449	621	17	1,668	
	34.8%	26.9%	37.2%	1.0%	100.0%	
	22.0%	21.5%	10.4%	17.9%	15.5%	
No Response	3	6	11	14	34	
	8.8%	17.6%	32.4%	41.2%	100.0%	
	0.1%	0.3%	0.2%	14.7%	0.3%	
TOTAL	2,639	2,084	5,977	95	10,795	
	24.4%	19.3%	55.4%	0.9%	100.0%	
	100.0%	100.0%	100.0%	100.0%	100.0%	

Table 3.5

ALL RESPONDENTS
according to WORK SPECIALTY and HIGHEST DEGREE
1986 Survey of ACS Members

	HIGHEST DEGREE					
WORK SPECIALTY	Bachelors	Masters	Doctorate	No Response	TOTAL	
Chemical engineering	207	177	318	4	706	-Count
	29.3%	25.1%	45.0%	0.6%	100.0%	-% of Row
	7.8%	8.5%	5.3%	4.2%	6.5%	-% of Col
Biochemistry	54	58	514	3	629	
	8.6%	9.2%	81.7%	0.5%	100.0%	
	2.0%	2.8%	8.6%	3.2%	5.8%	
Biotechnology	28	33	129	1	191	
	14.7%	17.3%	67.5%	0.5%	100.0%	
	1.1%	1.6%	2.2%	1.1%	1.8%	
General chemistry	119	151	201	2	473	
	25.2%	31.9%	42.5%	0.4%	100.0%	
	4.5%	7.2%	3.4%	2.1%	4.4%	
Analytical chemistry	734	429	703	7	1,873	
	39.2%	22.9%	37.5%	0.4%	100.0%	
	27.8%	20.6%	11.8%	7.4%	17.4%	
Inorganic chemistry	64	45	381	4	494	
	13.0%	9.1%	77.1%	0.8%	100.0%	
	2.4%	2.2%	6.4%	4.2%	4.6%	
Organic chemistry	215	192	872	9	1,288	
	16.7%	14.9%	67.7%	0.7%	100.0%	
	8.1%	9.2%	14.6%	9.5%	11.9%	
Polymer chemistry	325	207	598	11	1,141	
	28.5%	18.1%	52.4%	1.0%	100.0%	
	12.3%	9.9%	10.0%	11.6%	10.6%	
Pharmaceutical chemistry	88	51	165	3	307	
	28.7%	16.6%	53.7%	1.0%	100.0%	
	3.3%	2.4%	2.8%	3.2%	2.8%	
Medicinal/ clinical chemistry	44	52	233	3	332	
	13.3%	15.7%	70.2%	0.9%	100.0%	
	1.7%	2.5%	3.9%	3.2%	3.1%	
Theoretical chemistry	3	2	73	2	80	
	3.8%	2.5%	91.3%	2.5%	100.0%	
	0.1%	0.1%	1.2%	2.1%	0.7%	
Environmental chemistry	202	155	241	6	604	
	33.4%	25.7%	39.9%	1.0%	100.0%	
	7.7%	7.4%	4.0%	6.3%	5.6%	
Agricultural/ food chemistry	61	53	194	3	311	
	19.6%	17.0%	62.4%	1.0%	100.0%	
	2.3%	2.5%	3.2%	3.2%	2.9%	
Physical chemistry	57	51	521	4	633	
	9.0%	8.1%	82.3%	0.6%	100.0%	
	2.2%	2.4%	8.7%	4.2%	5.9%	
Other chemistry	83	89	161	3	336	
	24.7%	26.5%	47.9%	0.9%	100.0%	
	3.1%	4.3%	2.7%	3.2%	3.1%	
Non-chemistry	227	226	436	7	896	
	25.3%	25.2%	48.7%	0.8%	100.0%	
	8.6%	10.8%	7.3%	7.4%	8.3%	
No Response	128	113	237	23	501	
	25.5%	22.6%	47.3%	4.6%	100.0%	
	4.9%	5.4%	4.0%	24.2%	4.6%	
TOTAL	2,639	2,084	5,977	95	10,795	
	24.4%	19.3%	55.4%	0.9%	100.0%	
	100.0%	100.0%	100.0%	100.0%	100.0%	

Table 3.6

CHEMISTRY DEGREES GRANTED WOMEN: 1956-1985

	Bachelor's			Master's			Ph.D.		
	Total Men & Women	Women		Total Men & Women	Women		Total Men & Women	Women	
Academic Year		Number	% of Total		Number	% of Total		Number	% of Total
1955-56	6,178	1,182	19.1	1,164	129	11.1	986	52	5.3
1956-57	6,591	1,294	19.6	1,047	134	12.8	1,003	48	4.8
1957-58	7,010	1,305	18.6	1,125	167	14.8	939	49	5.2
1958-59	7,308	1,411	19.3	1,145	164	14.3	1,009	49	4.9
1959-60	7,603	1,598	21.0	1,228	203	16.5	1,048	48	4.6
1960-61	7,604	1,508	19.8	1,313	200	15.2	1,131	57	5.0
1961-62	8,089	1,715	21.2	1,425	246	17.3	1,139	69	6.1
1962-63	8,823	1,768	20.0	1,463	259	17.7	1,254	78	6.3
1963-64	9,724	1,915	19.7	1,586	280	17.7	1,301	93	7.1
1964-65	10,047	1,936	19.3	1,715	328	19.1	1,414	101	7.1
1965-66	9,735	1,801	18.5	1,839	355	19.3	1,571	94	6.0
1966-67	9,872	1,771	17.9	1,831	347	19.0	1,744	118	6.8
1967-68	10,847	1,965	18.1	2,014	418	20.8	1,757	142	8.1
1968-69	11,807	2,156	18.3	2,070	381	18.4	1,941	145	7.5
1969-70	11,617	2,116	18.2	2,146	480	22.4	2,208	169	7.7
1970-71	11,183	2,095	18.7	2,284	492	21.5	2,160	173	8.0
1971-72	10,721	2,120	19.8	2,259	505	22.4	1,971	193	9.8
1972-73	10,226	1,967	19.2	2,230	467	20.9	1,882	184	9.8
1973-74	10,525	2,112	20.0	2,138	474	22.2	1,828	173	9.5
1974-75	10,649	2,385	22.4	2,006	416	20.7	1,824	205	11.2
1975-76	11,107	2,497	22.5	1,796	383	21.3	1,623	197	12.1
1976-77	11,322	2,602	23.0	1,775	448	25.2	1,571	188	12.0
1977-78	11,474	2,881	25.1	1,892	445	23.5	1,525	203	13.3
1978-79	11,643	3,113	26.7	1,765	447	25.3	1,518	230	15.2
1979-80	11,232	3,182	28.3	1,723	444	25.7	1,545	258	15.5
1980-81	11,347	3,394	29.1	1,654	470	28.4	1,622	251	15.5
1981-82	11,062	3,491	31.6	1,742	488	28.0	1,708	278	16.3
1982-83	11,261	3,716	33.0	1.739	487	28.0	1,705	288	16.9
1983-84	10,704	3,731	34.9	1,667	530	31.8	1,744	319	18.3
1984-85	10,195	3,690	36.1	1,598	518	32.4	1,631	320	19.6

Source: Center for Education Statistics, Earned Degree Conferred series, unpublished data 1986.

Table 3.7

Field Selection of Women Doctorate Recipients, 1975 and 1985 (U.S. Citizens)

	Total U.S. Citizens*		Total U.S. Women*		Asian Women		Black Women		Hispanic Women		White Women	
	1975	1985	1975	1985	1975	1985	1975	1985	1975	1985	1975	1985
Physical Sciences	3,476 13.4	2,947 13.0	277 4.4	493 5.5	4 6.3	26 13.9	5 1.4	5 1.6	2 3.3	10 3.8	266 4.7	452 5.7
Engineering	1,641 6.3	1,223 5.4	32 0.5	114 1.3	1 1.6	14 7.5	0 0.0	3 0.6	0 0.0	0 0.0	31 0.5	97 1.2
Life Sciences	3,801 14.6	4,338 19.1	816 13.2	1,497 16.8	21 32.8	49 26.2	19 5.4	33 6.2	5 8.2	32 12.2	770 13.5	1,374 17.4
Social Sciences	4,935 19.0	4,432 19.5	1,326 21.4	2,017 22.6	10 15.6	28 15.0	47 13.5	95 17.9	9 14.8	59 22.6	1,258 22.0	1,826 23.1
Humanities	4,249 16.4	2,780 12.2	1,450 23.4	1,224 13.7	13 20.3	17 9.1	27 7.7	36 6.8	24 39.3	45 17.2	1,384 24.2	1,120 14.2
Education	6,603 25.4	5,668 25.0	2,086 33.7	3,083 34.5	12 18.8	45 24.1	233 66.8	318 59.9	20 32.8	98 37.6	1,818 31.8	2,595 32.9
Professional Fields	1,271 4.9	1,329 5.8	212 3.4	496 5.6	3 4.7	8 4.3	18 5.2	41 7.7	1 1.7	17 6.5	189 3.3	427 5.4
Total	25,976 100.0	22,717 100.0	6,199 100.0	8,924 100.0	64 100.0	187 100.0	349 100.0	531 100.0	61 100.0	261 100.0	5,716 100.0	7,891 100.0

*With known race/ethnicity.

CHAPTER IV

SALARIES AND EMPLOYMENT STATUS

Source of Tables:

Part A - ACS Starting Salaries 1986
Part B - ACS Salaries 1986

CHAPTER IV - SALARIES AND EMPLOYMENT STATUS

Summary of Findings

The data presented in this chapter are abstracted from two sources (1) Starting Salaries 1986, the ACS publication of data gathered from the annual survey of the graduating chemists and chemical engineers, and (2) Salaries 1986, the ACS publication of data gathered from the annual survey of ACS members.

INEXPERIENCED CHEMISTS AND CHEMICAL ENGINEERS

After two years of salary gains, salaries for inexperienced chemists and chemical engineers decreased in 1986 in both current and constant dollars, except for PhD chemists. The decrease reduced mean salaries in current dollars to little more than those that prevailed in 1984.

The recruitment of recent graduates continued to decline during 1985-86. Offers to BS chemists decreased by 26% as compared to the year before. The decrease in offers to chemical engineers was 20% less than the year before.

For inexperienced chemists, the 1986 mean starting salaries were:

approximately $19,000 for the BS, down 4% constant dollars.
approximately $24,000 for the MS, down 10% in constant dollars.
approximately $35,000 for the PhD, up 5% in constant dollars.

For chemical engineers, who continued to receive larger starting salaries than did chemists with similar degrees, the mean starting salaries were:

approximately $27,000 for the BS, down 2% in constant dollars.
approximately $30,000 for the MS, down 4% in constant dollars.
approximately $39,500 for the PhD, down 4% in constant dollars.

Throughout the 1980's unemployment among new graduates has vacillated. For example, among BS chemical engineers, the unemployment rate rose from 8% in 1981, peaked at 42% in 1983, and then leveled off around 22% thereafter.

Among chemists the unemployment rate for new graduates has not been quite so variable as among chemical engineers. For instance, in 1981 the unemployment rate among BS chemists was 23%. That rate peaked at 31% in 1983, and gradually dropped during the next three years reaching 13% in 1986.

Plans for advanced study and postdoctoral fellowship awards are indicators of demand for new doctorates. An increase in postdoctorate fellowships indicates a shortage of full-time job offers among chemistry graduates; 46.7% accepted postdoctoral position in 1986.

Chapter V, Supply and Demand, contains a discussion on some of the forces that influence the rise and fall of the unemployment rate among new graduates. In addition to the general well being of the economy, that discussion focuses also on how expenditures for national defense affect unemployment.

EXPERIENCED CHEMISTS AND CHEMICAL ENGINEERS

Despite higher unemployment, salaries continued to rise faster than inflation. In the period from March, 1985 to March, 1986, the overall median salary for PhD chemists increased 9% (to $47,800) while master's degree chemists reported an increase of 5% (to $37,900) and bachelor's degree chemists' median salary increased 3% (to $33,000). Because the Consumer Price Index rose only slightly over the same period, these salary increases represent increases in constant dollars. Salaries differed only slightly by geographic region and local section.

PhD salaries were highest for chemists in industry. Academic salaries were lower than those in industry or government even after academic year salaries were adjusted to a 12-month basis. The median salary of PhDs in industry was $50,000 and in government, $47,550. The median adjusted salary of academic PhDs was $42,700. Salaries for chemists employed in industry are generally higher for those working in the petroleum industry, those in R&D management, physical chemists, and those with greater experience.

As in the past, salaries for women chemists were lower than those for men. The average salary for women PhDs in industry and in government was 83% of that for men; in academia, 81%. The difference in men's and women's average salaries is partly due to differences in experience. When salaries are adjusted for differences in length of experience, the salary gap narrows. Another difference in men's and women's average salary can also be explained by differences in work function and academic rank. Women are more likely to be in research and teaching and men are more likely to be in management and administration. Men are more likely to be full professors, women are more likely to be assistant professors.

The overall unemployment rate among chemists increased in spring, 1986 to 1.7%, after having been 1.4% in 1985. Though high, the unemployment rate was still less than the 2.2% unemployment in 1983. As unemployment and the percent of part-time workers increased, the percent of chemists employed full-time decreased 0.8 percentage points to 93.6% of all chemists.

Unemployment rates were not uniform for all chemists. Generally speaking, unemployment rates were higher for those chemists with only BS degrees, women, Blacks, Hispanics, older chemists, and chemists employed in industry. Unemployment was twice as high among BS chemists (2.6%) as among PhD chemists (1.3%).

The unemployment rate for minority chemists was almost twice as high as that for whites, approximately 3% versus 1.7%.

Unemployment rates were highest for chemists in the 55-59 and 60-64 age groups (2.7% and 2.6% respectively).

Chemists employed in industry have a higher rate of unemployment (2.2%) than chemists in any other type of employment. The unemployment rate for chemists in academia is 0.8% in government 0.3%, and in other nonacademic employment 1.6%. The length of unemployment for unemployed chemists was larger in 1985-86 than in previous years. More than 30% of those unemployed reported they had been unemployed for more than a year. Chemists most likely to be unemployed for extended periods of time were those in the West South Central region, older chemists, and chemists without advanced degrees.

Table 4.1.a

STARTING YEARLY SALARIES OF INEXPERIENCED FULL-TIME EMPLOYED CHEMISTRY GRADUATES

by Degree: 1985 and 1986

	DEGREE LEVEL					
Salaries	Bachelor's		Master's		Ph.D.	
	1985	1986	1985	1986	1985	1986
90th Percentile	$24,772	$25,000	$32,100	$32,000	$38,880	$42,000
75th Percentile	22,800	22,250	30,000	28,500	37,725	40,000
50th Percentile	19,500	18,600	27,000	26,100	35,850	38,000
25th Percentile	17,000	15,000	23,500	20,500	30,000	32,000
10th Percentile	14,000	13,000	17,720	15,000	21,300	27,000
Mean	19,708	18,995	26,432	24,065	33,096	35,107
Count	296	175	45	20	92	43
Standard Deviation	4,200	6,744	5,886	7,697	6,977	8,781

Table 4.2.a

STARTING YEARLY SALARIES OF INEXPERIENCED FULL-TIME EMPLOYED CHEMICAL ENGINEERING GRADUATES

by Degree: 1985 and 1986

Salaries	DEGREE LEVEL					
	Bachelor's		Master's		Ph.D.	
	1985	1986	1985	1986	1985	1986
90th Percentile	$30,000	$31,000	$33,532	$36,000	$45,000	$45,500
75th Percentile	29,100	30,000	32,000	33,000	43,000	43,300
50th Percentile	28,020	28,360	31,400	31,000	40,000	41,500
25th Percentile	26,000	24,000	30,000	29,500	39,480	40,000
10th Percentile	22,100	20,000	26,000	22,000	38,000	30,000
Mean	27,099	26,899	30,742	29,996	40,993	39,485
Count	481	460	48	43	47	49
Standard Deviation	3,340	5,369	4,285	7,207	3,101	6,899

Table 4.3.a

POSTGRADUATION STATUS OF CHEMISTRY AND CHEMICAL ENGINEERING GRADUATES: FALL 1986

Major and Employment Status	Bachelor's	Master's	Doctorates
CHEMISTRY			
Full-time employed:			
In chemistry or chemical engineering	33.9%	42.6%	48.3%
Outside chemistry or chemical engineering	8.3	11.8	2.5
Grad. asst./postdoctoral or other fellowship	26.1	33.8	46.7
Unemployed and seeking full-time employment	10.4	4.4	2.5
Unemployed and not seeking full-time employment	21.2	7.4	0.0
Total	100.0	100.0	100.0
Number of responses	528	68	120
CHEMICAL ENGINEERING			
Full-time employed:			
In chemistry or chemical engineering	42.6	39.6	77.7
Outside chemistry or chemical engineering	19.1	8.3	6.4
Grad. asst./postdoctoral or other fellowship	14.2	38.2	12.8
Unemployed and seeking full-time employment	20.2	9.0	2.1
Unemployed and not seeking full-time employment	3.8	4.9	1.1
Total	100.0	100.0	100.0
Number of responses	936	144	94

Table 4.4.a

SALARIES of INEXPERIENCED CHEMISTS employed FULL-TIME
according to DEGREE and SEX
1986 Starting Salary Survey

	HIGHEST DEGREE		
	BS	MS	PHD
SEX			
MEN			
Median	19,000	22,106	37,650
Mean	19,242	21,145	35,078
Std Dev	7,855	9,248	8,232
Count	104	10	36
WOMEN			
Median	18,000	27,900	38,000
Mean	18,641	26,985	35,259
Std Dev	4,751	4,602	12,015
Count	71	10	7
TOTAL			
Median	18,600	26,100	38,000
Mean	18,995	24,065	35,107
Std Dev	6,744	7,697	8,781
Count	175	20	43

Table 4.5.a

SALARIES of INEXPERIENCED CHEMICAL ENGINEERS employed FULL-TIME
according to DEGREE and SEX
1986 Starting Salary Survey

	HIGHEST DEGREE		
	BS	MS	PHD
SEX			
MEN			
Median	28,200	31,000	41,250
Mean	26,782	30,324	39,528
Std Dev	5,654	6,382	6,690
Count	318	35	42
WOMEN			
Median	28,750	31,000	42,000
Mean	27,161	28,563	39,229
Std Dev	4,676	10,534	8,653
Count	142	8	7
TOTAL			
Median	28,360	31,000	41,500
Mean	26,899	29,996	39,485
Std Dev	5,369	7,207	6,899
Count	460	43	49

Table 4.6.a

CHEMISTRY GRADUATES WHO PLAN FULL-TIME STUDIES IN FALL 1986
according to FIELD OF ADVANCED STUDY, SEX, and DEGREE
1986 Starting Salary Survey

	BACHELORS			MASTERS			DOCTORATE		
	SEX								
	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL
STUDY FIELD									
CHEMISTRY	66	32	98	14	4	18	8	0	8
Row Percent	67.3%	32.7%	100.0%	77.8%	22.2%	100.0%	100.0%	0.0%	100.0%
Column Percent	37.1%	36.0%	36.7%	77.8%	50.0%	69.2%	72.7%	0.0%	72.7%
OTHER PHYSICAL SCIENCE	2	2	4	0	1	1	0	0	0
Row Percent	50.0%	50.0%	100.0%	0.0%	100.0%	100.0%	0.0%	0.0%	0.0%
Column Percent	1.1%	2.2%	1.5%	0.0%	12.5%	3.8%	0.0%	0.0%	0.0%
CHEMICAL ENGINEERING	0	2	2	0	0	0	0	0	0
Row Percent	0.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Column Percent	0.0%	2.2%	.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
OTHER ENGINEERING	2	3	5	0	0	0	0	0	0
Row Percent	40.0%	60.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Column Percent	1.1%	3.4%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
BIOCHEMISTRY	14	5	19	3	1	4	3	0	3
Row Percent	73.7%	26.3%	100.0%	75.0%	25.0%	100.0%	100.0%	0.0%	100.0%
Column Percent	7.9%	5.6%	7.1%	16.7%	12.5%	15.4%	27.3%	0.0%	27.3%
LIFE SCIENCE	4	1	5	0	0	0	0	0	0
Row Percent	80.0%	20.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Column Percent	2.2%	1.1%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
MEDICINE	74	27	101	1	2	3	0	0	0
Row Percent	73.3%	26.7%	100.0%	33.3%	66.7%	100.0%	0.0%	0.0%	0.0%
Column Percent	41.6%	30.3%	37.8%	5.6%	25.0%	11.5%	0.0%	0.0%	0.0%
DENTISTRY	5	1	6	0	0	0	0	0	0
Row Percent	83.3%	16.7%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Column Percent	2.8%	1.1%	2.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
PHARMACY	1	3	4	0	0	0	0	0	0
Row Percent	25.0%	75.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Column Percent	.6%	3.4%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
BUSINESS	6	2	8	0	0	0	0	0	0
Row Percent	75.0%	25.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Column Percent	3.4%	2.2%	3.0%	0.0%	0.0%	0.0%	0.0%	[illegible]	0.0%
EDUCATION	0	2	2	0	0	0	0	0	0
Row Percent	0.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Column Percent	0.0%	2.2%	.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
OTHER	4	9	13	0	0	0	0	0	0
Row Percent	30.8%	69.2%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Column Percent	2.2%	10.1%	4.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL	178	89	267	18	8	26	11	0	11
Row Percent	66.7%	33.3%	100.0%	69.2%	30.8%	100.0%	100.0%	0.0%	100.0%
Column Percent	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	0.0%	100.0%

Table 4.7.a

CHEMICAL ENGINEERING GRADUATES WHO PLAN FULL-TIME STUDIES IN FALL 1986
according to FIELD OF ADVANCED STUDY, SEX, and DEGREE
1986 Starting Salary Survey

	BACHELORS			MASTERS		
	SEX					
STUDY FIELD	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL
CHEMISTRY	3	1	4	1	0	1
Row Percent	75.0%	25.0%	100.0%	100.0%	0.0%	100.0%
Column Percent	2.1%	2.8%	2.2%	2.1%	0.0%	1.6%
OTHER PHYSICAL SCIENCE	2	0	2	0	0	0
Row Percent	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%
Column Percent	1.4%	0.0%	1.1%	0.0%	0.0%	0.0%
CHEMICAL ENGINEERING	99	20	119	38	11	49
Row Percent	83.2%	16.8%	100.0%	77.6%	22.4%	100.0%
Column Percent	68.8%	55.6%	66.1%	80.9%	73.3%	79.0%
OTHER ENGINEERING	6	6	12	2	1	3
Row Percent	50.0%	50.0%	100.0%	66.7%	33.3%	100.0%
Column Percent	4.2%	16.7%	6.7%	4.3%	6.7%	4.8%
LIFE SCIENCE	1	1	2	0	0	0
Row Percent	50.0%	50.0%	100.0%	0.0%	0.0%	0.0%
Column Percent	.7%	2.8%	1.1%	0.0%	0.0%	0.0%
MEDICINE	13	5	18	2	1	3
Row Percent	72.2%	27.8%	100.0%	66.7%	33.3%	100.0%
Column Percent	9.0%	13.9%	10.0%	4.3%	6.7%	4.8%
PHARMACY	1	0	1	0	0	0
Row Percent	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%
Column Percent	.7%	0.0%	.6%	0.0%	0.0%	0.0%
BUSINESS	14	1	15	2	1	3
Row Percent	93.3%	6.7%	100.0%	66.7%	33.3%	100.0%
Column Percent	9.7%	2.8%	8.3%	4.3%	6.7%	4.8%
LAW	3	1	4	1	0	1
Row Percent	75.0%	25.0%	100.0%	100.0%	0.0%	100.0%
Column Percent	2.1%	2.8%	2.2%	2.1%	0.0%	1.6%
OTHER	2	1	3	1	1	2
Row Percent	66.7%	33.3%	100.0%	50.0%	50.0%	100.0%
Column Percent	1.4%	2.8%	1.7%	2.1%	6.7%	3.2%
TOTAL	144	36	180	47	15	62
Row Percent	80.0%	20.0%	100.0%	75.8%	24.2%	100.0%
Column Percent	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 4.1.b

EMPLOYMENT STATUS of ALL CHEMISTS
according to GEOGRAPHIC REGION
1986 Survey of ACS Members

EMPLOYMENT STATUS

GEOGRAPHIC REGION	Employed full-time	Employed part-time	Postdoc. or other fellow.	Un-employed seeking	Un-employed Not seek.	No Response	TOTAL	
Pacific	1,047	20	28	12	12	4	1,123	-Count
	93.2%	1.8%	2.5%	1.1%	1.1%	0.4%	100.0%	-% of Row
	12.0%	13.7%	16.3%	7.7%	11.1%	14.8%	12.0%	-% of Col
Mountain	333	6	13	6	3	0	361	
	92.2%	1.7%	3.6%	1.7%	0.8%	0.0%	100.0%	
	3.8%	4.1%	7.6%	3.8%	2.8%	0.0%	3.9%	
W.N. Central	527	10	13	8	6	1	565	
	93.3%	1.8%	2.3%	1.4%	1.1%	0.2%	100.0%	
	6.0%	6.8%	7.6%	5.1%	5.6%	3.7%	6.1%	
W.S. Central	661	5	9	19	13	3	710	
	93.1%	0.7%	1.3%	2.7%	1.8%	0.4%	100.0%	
	7.6%	3.4%	5.2%	12.2%	12.0%	11.1%	7.6%	
E.N. Central	1,762	23	37	21	21	3	1,867	
	94.4%	1.2%	2.0%	1.1%	1.1%	0.2%	100.0%	
	20.2%	15.8%	21.5%	13.5%	19.4%	11.1%	20.0%	
E.S. Central	316	7	0	5	6	1	335	
	94.3%	2.1%	0.0%	1.5%	1.8%	0.3%	100.0%	
	3.6%	4.8%	0.0%	3.2%	5.6%	3.7%	3.6%	
Mid-Atlantic	1,982	37	24	49	19	10	2,121	
	93.4%	1.7%	1.1%	2.3%	0.9%	0.5%	100.0%	
	22.7%	25.3%	14.0%	31.4%	17.6%	37.0%	22.7%	
So. Atlantic	1,347	21	22	21	19	3	1,433	
	94.0%	1.5%	1.5%	1.5%	1.3%	0.2%	100.0%	
	15.4%	14.4%	12.8%	13.5%	17.6%	11.1%	15.4%	
New England	613	12	23	12	8	0	668	
	91.8%	1.8%	3.4%	1.8%	1.2%	0.0%	100.0%	
	7.0%	8.2%	13.4%	7.7%	7.4%	0.0%	7.2%	
No Response	134	5	3	3	1	2	148	
	90.5%	3.4%	2.0%	2.0%	0.7%	1.4%	100.0%	
	1.5%	3.4%	1.7%	1.9%	0.9%	7.4%	1.6%	
TOTAL	8,[illegible]2	146	172	156	108	27	9,331	
	93.5%	1.6%	1.8%	1.7%	1.2%	0.3%	100.0%	
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Table 4.2.b

EMPLOYMENT STATUS of ALL CHEMISTS
according to TYPE OF EMPLOYER
1986 Survey of ACS Members

	EMPLOYMENT STATUS							
EMPLOYER TYPE	Employed full-time	Employed part-time	Postdoc. or other fellow.	Un-employed seeking	Un-employed Not seek.	No Response	TOTAL	
Industry	5,395 95.7% 61.9%	37 0.7% 25.3%	3 0.1% 1.7%	125 2.2% 80.1%	59 1.0% 54.6%	16 0.3% 59.3%	5,635 100.0% 60.4%	-Count -% of Row -% of Col
Government	884 96.1% 10.1%	10 1.1% 6.8%	16 1.7% 9.3%	3 0.3% 1.9%	6 0.7% 5.6%	1 0.1% 3.7%	920 100.0% 9.9%	
Other	494 87.9% 5.7%	37 6.6% 25.3%	5 0.9% 2.9%	9 1.6% 5.8%	15 2.7% 13.9%	2 0.4% 7.4%	562 100.0% 6.0%	
High School	116 92.1% 1.3%	3 2.4% 2.1%	0 0.0% 0.0%	2 1.6% 1.3%	4 3.2% 3.7%	1 0.8% 3.7%	126 100.0% 1.4%	
College or University	1,677 88.0% 19.2%	53 2.8% 36.3%	137 7.2% 79.7%	15 0.8% 9.6%	19 1.0% 17.6%	5 0.3% 18.5%	1,906 100.0% 20.4%	
No Response	156 85.7% 1.8%	6 3.3% 4.1%	11 6.0% 6.4%	2 1.1% 1.3%	5 2.7% 4.6%	2 1.1% 7.4%	182 100.0% 2.0%	
TOTAL	8,722 93.5% 100.0%	146 1.6% 100.0%	172 1.8% 100.0%	156 1.7% 100.0%	108 1.2% 100.0%	27 0.3% 100.0%	9,331 100.0% 100.0%	

Table 4.3.b

EMPLOYMENT STATUS of ALL CHEMISTS
according to RACE/ETHNICITY
1986 Survey of ACS Members

	EMPLOYMENT STATUS							
RACE/ETHNICITY	Employed full-time	Employed part-time	Postdoc. or other fellow.	Un-employed seeking	Un-employed Not seek.	No Response	TOTAL	
Black	96	2	1	3	1	1	104	-Count
	92.3%	1.9%	1.0%	2.9%	1.0%	1.0%	100.0%	-% of Row
	1.1%	1.4%	0.6%	1.9%	0.9%	3.7%	1.1%	-% of Col
Hispanic	89	0	3	3	0	0	95	
	93.7%	0.0%	3.2%	3.2%	0.0%	0.0%	100.0%	
	1.0%	0.0%	1.7%	1.9%	0.0%	0.0%	1.0%	
American Indian	13	1	0	1	0	0	15	
	86.7%	6.7%	0.0%	6.7%	0.0%	0.0%	100.0%	
	0.1%	0.7%	0.0%	0.6%	0.0%	0.0%	0.2%	
Asian	477	9	29	9	3	3	530	
	90.0%	1.7%	5.5%	1.7%	0.6%	0.6%	100.0%	
	5.5%	6.2%	16.9%	5.8%	2.8%	11.1%	5.7%	
White	7,905	131	137	138	101	22	8,434	
	93.7%	1.6%	1.6%	1.6%	1.2%	0.3%	100.0%	
	90.6%	89.7%	79.7%	88.5%	93.5%	81.5%	90.4%	
Other Race	42	2	1	1	0	0	46	
	91.3%	4.3%	2.2%	2.2%	0.0%	0.0%	100.0%	
	0.5%	1.4%	0.6%	0.6%	0.0%	0.0%	0.5%	
No Response	100	1	1	1	3	1	107	
	93.5%	0.9%	0.9%	0.9%	2.8%	0.9%	100.0%	
	1.1%	0.7%	0.6%	0.6%	2.8%	3.7%	1.1%	
TOTAL	8,722	146	172	156	108	27	9,331	
	93.5%	1.6%	1.8%	1.7%	1.2%	0.3%	100.0%	
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Table 4.4.b

EMPLOYMENT STATUS of ALL CHEMISTS
according to HIGHEST DEGREE
1986 Survey of ACS Members

	EMPLOYMENT STATUS							
HIGHEST DEGREE	Employed full-time	Employed part-time	Postdoc. or other fellow.	Un-employed seeking	Un-employed Not seek	No Response	TOTAL	
Bachelors	2,105	32	1	58	42	4	2,242	-Count
	93.9%	1.4%	0.0%	2.6%	1.9%	0.2%	100.0%	-% of Row
	24.1%	21.9%	0.6%	37.2%	38.9%	14.8%	24.0%	-% of Col
Masters	1,593	36	2	28	24	8	1,691	
	94.2%	2.1%	0.1%	1.7%	1.4%	0.5%	100.0%	
	18.3%	24.7%	1.2%	17.9%	22.2%	29.6%	18.1%	
Doctorate	4,965	77	168	68	41	14	5,333	
	93.1%	1.4%	3.2%	1.3%	0.8%	0.3%	100.0%	
	56.9%	52.7%	97.7%	43.6%	38.0%	51.9%	57.2%	
No Response	59	1	1	2	1	1	65	
	90.8%	1.5%	1.5%	3.1%	1.5%	1.5%	100.0%	
	0.7%	0.7%	0.6%	1.3%	0.9%	3.7%	0.7%	
TOTAL	8,722	146	172	156	108	27	9,331	
	93.5%	1.6%	1.8%	1.7%	1.2%	0.3%	100.0%	
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Table 4.5.b

SALARIES of FULL-TIME EMPLOYED B.S. CHEMISTS
according to TYPE OF EMPLOYER and YEARS SINCE BS
1986 Survey of ACS Members

	YEARS SINCE BS											
EMPLOYER TYPE	0-1	2-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	>=40	No Resp	TOTAL	
Industry	25000	27000	34900	41000	46000	50000	52000	55000	55000	60450	40000	44200	- 75th %-ile
	22550	24600	30000	35000	39000	43900	43000	45300	48000	44700	25000	34600	- 50th %-ile
	19650	21850	25900	28700	32050	37000	35000	36425	40000	35000	19800	26600	- 25th %-ile
	22500	24918	30141	36072	40017	43617	44925	47232	48809	47178	28267	36628	- Mean
	4106	6071	6574	9618	9943	11516	13360	15161	14696	17960	10489	13447	- Std Dev
	46	216	335	216	157	109	85	110	149	49	3	1,475	- Count
Government	---	23300	31900	36800	39700	45050	50000	47800	54000	49500	---	40000	
	21000	19700	25750	30500	37000	37900	41100	39000	38000	38000	---	32000	
	---	12000	22250	25000	31500	28300	40000	33300	29600	31900	---	24600	
	21000	20563	26440	31788	37508	37024	44479	43229	41767	39933	---	33557	
	---	3822	6353	7594	9296	9158	10951	14819	13636	9787	---	11784	
	1	27	40	40	25	25	19	17	15	6	0	215	
Other Non-profit, Self-employed	19200	23000	30125	37250	43500	60000	41500	49875	51250	44500	---	40375	
	18000	19500	24600	33000	39850	51000	34000	41250	43800	38500	---	28000	
	16000	18000	20300	25950	24000	23100	23667	33600	28500	30875	---	21600	
	17767	20560	26103	33618	36170	45022	32858	42300	44460	38417	---	31513	
	2311	3996	8216	10365	9154	21586	10120	10410	22886	7088	---	14093	
	9	15	30	17	10	9	8	6	10	6	0	120	
High School	---	21511	21764	---	---	---	---	---	---	---	---	30220	
	17722	18333	19556	28111	22978	31778	36667	---	50355	29883	---	22006	
	---	14667	18639	---	---	---	---	---	---	---	---	18333	
	17722	17521	19986	28111	22978	31778	36667	---	50355	29883	---	23904	
	---	3930	1772	6914	---	---	---	---	---	6136	---	9190	
	1	7	4	2	1	1	1	0	1	2	0	20	
College/ University	17000	17000	24295	25050	31250	---	---	---	---	---	---	24000	
	17000	16000	23150	24000	24500	---	24500	24000	30000	---	---	18300	
	14000	13625	20650	22500	17225	---	---	---	---	---	---	16000	
	16000	15303	22346	23850	24383	---	24500	24000	30000	---	---	20297	
	1732	2404	3014	1399	7611	---	9192	---	---	---	---	5863	
	3	12	6	4	5	0	2	1	1	0	0	35	
No Response	---	---	33700	---	---	---	---	---	---	---	---	40739	
	39478	25100	27000	35600	38200	26400	45000	50000	---	36000	---	35600	
	---	---	12800	---	---	---	---	---	---	---	---	25750	
	39478	25100	24500	35600	38200	26400	45000	50000	---	36000	---	34137	
	---	---	11259	---	---	---	---	11314	---	---	---	11879	
	1	1	4	1	1	1	1	2	0	1	0	13	
TOTAL	24000	26425	33500	40000	45000	50000	50000	54675	55000	55650	40000	43000	
	21000	23550	28800	34100	38700	42900	42500	44800	47000	41500	25000	33000	
	18150	19675	24600	28000	31500	36000	35000	36200	39000	34056	19800	25500	
	21657	23659	29236	35078	38947	42367	43597	46384	47863	44962	28267	35492	
	4840	6166	6917	9503	10119	12185	13128	14935	15196	16636	10489	13454	
	61	278	419	280	200	145	116	136	176	64	3	1,878	

Table 4.6.b

SALARIES of FULL-TIME EMPLOYED M.S. CHEMISTS
according to TYPE OF EMPLOYER and YEARS SINCE BS
1986 Survey of ACS Members

YEARS SINCE BS

EMPLOYER TYPE	0-1	2-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	>=40	No Resp	TOTAL	
Industry	---	30000	35800	43000	48000	55000	55000	60125	60000	65850	---	50000	- 75th %-ile
	---	27100	31200	36000	41000	43000	47200	50006	51200	52550	42850	40000	- 50th %-ile
	---	25000	28000	32000	35000	35750	38625	40650	44800	43050	---	32000	- 25th %-ile
	---	27868	31915	37186	42148	45848	47258	51102	53029	55717	42850	42094	- Mean
	---	4247	5875	8348	10455	13425	14443	14800	13623	17212	11809	13413	- Std Dev
	0	25	167	207	182	121	84	86	93	36	2	993	- Count
Government	---	29900	32000	37500	35800	43550	53000	56000	58750	48000	---	44350	
	---	26300	26500	32700	34700	36500	41150	52100	47450	46300	30700	35500	
	---	23650	24000	25900	30000	33700	34500	39000	41750	32750	---	29000	
	---	26680	26858	32700	34857	38282	43550	45888	47163	41560	30700	37362	
	---	3275	6386	6771	7165	8162	10056	14845	14152	9757	---	11471	
	0	5	19	25	23	28	12	16	18	5	1	152	
Other Non-profit, Self-employed	---	30300	34800	35875	42000	43000	32000	---	51225	45000	---	40000	
	---	22850	30000	32000	37889	36000	25000	50000	44750	29250	---	33000	
	---	17125	24500	27200	32000	30000	20000	---	31125	23250	---	27000	
	---	23425	28821	32638	37653	38189	31857	50000	42350	31583	---	34000	
	---	7224	7734	6244	14005	10200	20219	---	11114	11647	---	11815	
	0	4	19	16	15	9	7	1	10	6	0	87	
High School	---	---	20778	29500	39111	41555	40333	47667	45583	42000	---	39111	
	---	---	17056	28111	30556	34345	36339	39111	41056	31778	---	33611	
	---	---	13250	17000	27500	25000	32000	36667	27653	29000	---	26000	
	---	---	17028	24801	31883	33564	37580	41148	38097	34259	---	32849	
	---	---	4083	8373	9698	10473	10259	5776	3970	6846	---	10781	
	0	0	4	7	7	14	14	3	4	3	0	56	
College/ University	---	23617	26000	35000	41300	40683	44061	49195	40000	45222	---	39111	
	---	22000	25000	28500	27711	33367	41555	36789	37584	34222	23223	30800	
	---	10956	20000	23344	25336	24350	33611	33703	33375	30556	---	25000	
	---	18229	23233	28542	30998	33339	37557	39824	35935	36595	23223	31838	
	---	7236	4076	7279	8718	9183	10751	7843	8258	9025	3457	9707	
	0	5	11	23	14	20	17	6	14	7	2	119	
No Response	---	---	---	43500	38000	---	---	---	---	75300	---	38850	
	---	31000	19500	38700	30000	38000	25000	---	---	39600	---	31000	
	---	---	---	23350	23222	---	---	---	---	27000	---	24111	
	---	31000	19500	34480	30407	38000	25000	---	---	47300	---	34460	
	---	---	707	10963	7397	---	---	---	---	26610	---	15782	
	0	1	2	5	3	1	1	0	0	4	0	17	
TOTAL	---	30000	34625	40000	46400	49000	52000	58800	56000	55500	42850	47075	
	---	26800	30000	35000	39156	40944	43144	48695	48500	45500	30700	37889	
	---	23000	26150	29500	33000	33617	35000	39308	40100	33611	23223	30150	
	---	26149	30407	35475	40105	42165	43752	49477	49064	48381	32569	39783	
	---	5738	6708	8618	10871	12931	14361	14550	14152	18014	11630	13298	
	0	40	222	283	244	193	135	112	129	61	5	1,424	

Table 4.7.b

SALARIES of FULL-TIME EMPLOYED Ph.D. CHEMISTS
according to TYPE OF EMPLOYER and YEARS SINCE BS
1986 Survey of ACS Members

YEARS SINCE BS

EMPLOYER TYPE	0-1	2-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	>=40	No Resp	TOTAL	
Industry	43500	---	42075	49000	56800	55000	67375	74500	78500	72478	57000	61000	- 75th %-ile
	29000	32750	39600	44000	49150	56100	58000	63000	64000	63500	39400	50000	- 50th %-ile
	21500	---	37500	40000	43350	48000	49000	49950	52000	51075	27425	42000	- 25th %-ile
	31333	32750	40076	44850	50536	57323	59027	61388	65033	62476	41713	52979	- Mean
	11184	1768	5510	7819	11126	13160	14609	16641	15793	15393	14968	14587	- Std Dev
	3	2	274	441	426	392	284	217	195	80	8	2,322	- Count
Government	---	---	42625	45000	50000	55950	56500	60675	67000	66000	---	56000	
	---	28500	34350	40750	42600	48000	49100	50650	57800	54000	28000	47550	
	---	---	28250	36600	35300	41250	42000	45000	48450	38700	---	40000	
	---	28500	35046	39997	42925	48258	50388	52173	56682	52991	28000	48006	
	---	---	7744	7482	8868	9457	9686	10881	11913	12422	---	11484	
	0	1	28	32	65	88	67	64	49	23	1	418	
Other Non-profit, Self-employed	---	---	39700	47400	58250	61500	56525	69200	70000	83875	---	61000	
	---	21000	35500	38600	45300	50000	49795	50000	59050	70000	70000	49000	
	---	---	32675	30125	39100	39311	37750	44000	51500	53500	---	37900	
	---	21000	35217	39038	50475	51143	47630	55246	59839	67072	70000	50828	
	---	---	6768	14403	18036	16990	13922	15572	14644	21628	---	17976	
	0	1	12	32	36	37	26	26	28	19	1	217	
High School	---	---	---	---	37800	80789	57078	67222	63555	---	---	52984	
	---	---	---	23222	30199	41555	31289	42778	48889	25667	---	35444	
	---	---	---	---	28111	27500	25300	31722	47000	---	---	27750	
	---	---	---	23222	32033	51627	36266	48133	53148	25667	---	41454	
	---	---	---	---	5101	28845	14788	23936	9062	---	---	19196	
	0	0	0	1	3	5	11	5	3	1	0	29	
College/ University	---	---	32875	36361	42945	49359	55000	60000	62800	73253	---	53289	
	---	7000	29167	30556	35444	42778	46444	50056	52555	59945	59400	42655	
	---	---	25542	26945	30000	35458	39000	41666	44500	48917	---	33336	
	---	7000	29278	31852	37692	43814	47368	51976	54273	60648	59400	44667	
	---	---	6133	7672	11600	12227	12631	14594	14927	16576	---	15204	
	0	1	68	165	192	296	212	200	139	88	1	1,362	
No Response	---	---	39000	37375	61766	52922	60000	57250	59667	84389	---	56550	
	---	---	26644	33667	51945	45000	48600	52000	50056	52889	---	47361	
	---	---	15000	29350	37681	35528	40333	41461	32750	45000	---	36917	
	---	---	26881	33772	50696	46699	50710	49960	49268	56678	---	48347	
	---	---	12002	4815	13600	17585	13813	8894	16439	25230	---	16164	
	0	0	3	6	8	25	23	17	10	10	0	102	
TOTAL	43500	32750	41300	47500	53125	60000	61600	66000	70000	71975	60000	58617	
	29000	28500	38400	41000	45000	49500	51700	53533	58800	60000	42000	47789	
	21500	14000	34850	35000	38225	41000	42778	45000	48892	50000	28000	39575	
	31333	24400	37548	41047	46403	51014	52946	55921	59742	60698	44645	49682	
	11184	10882	7253	9878	12834	14326	14619	15733	15803	17020	16658	15238	
	3	5	385	677	730	843	623	529	424	220	11	4,450	

Table 4.8.b

LENGTH of UNEMPLOYMENT of CHEMISTS UNEMPLOYED on MARCH 1, 1986
according to GEOGRAPHIC REGION
1986 Survey of ACS Members

	MONTHS UNEMPLOYED							
GEOGRAPHIC REGION	<=1	1-3	4-6	7-12	>=12	No Response	TOTAL	
Pacific	1	6	1	7	7	2	24	-Count
	4.2%	25.0%	4.2%	29.2%	29.2%	8.3%	100.0%	-% of Row
	4.2%	9.8%	3.4%	17.9%	8.5%	6.9%	9.1%	-% of Col
Mountain	0	4	2	1	1	1	9	
	0.0%	44.4%	22.2%	11.1%	11.1%	11.1%	100.0%	
	0.0%	6.6%	6.9%	2.6%	1.2%	3.4%	3.4%	
W.N. Central	2	4	1	2	3	2	14	
	14.3%	28.6%	7.1%	14.3%	21.4%	14.3%	100.0%	
	8.3%	6.6%	3.4%	5.1%	3.7%	6.9%	5.3%	
W.S. Central	3	4	5	4	14	2	32	
	9.4%	12.5%	15.6%	12.5%	43.8%	6.3%	100.0%	
	12.5%	6.6%	17.2%	10.3%	17.1%	6.9%	12.1%	
E.N. Central	0	14	3	6	13	6	42	
	0.0%	33.3%	7.1%	14.3%	31.0%	14.3%	100.0%	
	0.0%	23.0%	10.3%	15.4%	15.9%	20.7%	15.9%	
E.S. Central	1	3	2	1	3	1	11	
	9.1%	27.3%	18.2%	9.1%	27.3%	9.1%	100.0%	
	4.2%	4.9%	6.9%	2.6%	3.7%	3.4%	4.2%	
Mid-Atlantic	8	13	9	10	22	6	68	
	11.8%	19.1%	13.2%	14.7%	32.4%	8.8%	100.0%	
	33.3%	21.3%	31.0%	25.6%	26.8%	20.7%	25.8%	
So. Atlantic	5	6	3	5	15	6	40	
	12.5%	15.0%	7.5%	12.5%	37.5%	15.0%	100.0%	
	20.8%	9.8%	10.3%	12.8%	18.3%	20.7%	15.2%	
New England	3	7	2	3	4	1	20	
	15.0%	35.0%	10.0%	15.0%	20.0%	5.0%	100.0%	
	12.5%	11.5%	6.9%	7.7%	4.9%	3.4%	7.6%	
No Response	1	0	1	0	0	2	4	
	25.0%	0.0%	25.0%	0.0%	0.0%	50.0%	100.0%	
	4.2%	0.0%	3.4%	0.0%	0.0%	6.9%	1.5%	
TOTAL	24	61	29	39	82	29	264	
	9.1%	23.1%	11.0%	14.8%	31.1%	11.0%	100.0%	
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

CHAPTER V

SUPPLY AND DEMAND OF SCIENTISTS AND ENGINEERS

CHAPTER V - SUPPLY AND DEMAND OF SCIENTISTS AND ENGINEERS

Overview

The supply of persons in the science and engineering fields, ideally, should exactly meet the demands of industry, government, academia and other employers. By demand, it is meant the number of jobs that employers wish to fill with persons adequately trained in the fields of science and engineering (S/E). By supply, it is meant the number of scientists, engineers and technicians (SET) adequately trained and available to meet the demands of employers. Because the balance between supply and demand is in constant flux, it is difficult to predict the number of students that should be trained by colleges and universities as scientists, engineers and technicians in order to qualify them for proper job specialties. Because the labor pool of SET are highly skilled, increasing or decreasing the supply of trained scientists and engineers requires a lead time of four to eight years. Projections of demand sometimes are made by estimating a value for some factor as Gross National Product (GNP) and assuming that some proportion of the GNP can be translated into jobs for S/E. Still other projections are based on an effort to predict how much funding will be applied to national defense, and this funding may be translated into manpower demand for S/E.

This chapter takes a broad look at several analyses of the supply of, and demand for, scientists and engineers, including projections of the supply-demand picture. Any projection, of course, is subject to many indeterminate variables and therefore is subject to error. No matter how sophisticated the projection model, it is no better than the assumptions on which it rests. General performance of the economy has an important influence on labor projections, and that may be based on two major factors: macroeconomic conditions and defense spending.

Macroeconomic assumptions

1. Low-growth scenario. The economy is in a low growth period when the GNP registers an annual growth rate of about 2 percent. This scenario, one of high inflation and a stagnant economy (stagflation), is referred to as "STAG."

2. High-growth scenario. In this scenario the real annual growth of GNP exceeds 4 percent. This scenario, one of low inflation and a high growth economy, is referred to as "OPTIM."

Defense expenditure assumptions

In the high-defense expenditure scenario, the total appropriation for defense expenditures would be an 8 percent average annual increase in constant dollars. That scenario will be called HIGH.

Defense expenditure is considered low when defense spending is constrained to 3 percent real growth. That scenario will be called LOW.

Thus the projected range of employment in science, engineering and technician occupations 1982-1987 is seen in Charts V.2.a and V.3.a in scenarios of a high growth economy and high defense expenditures, referred to as OPTIM/HIGH, and a stagnated economy with low defense expenditures, reffered to as STAG/LOW.

In a telephone interview 3/17/87, Dr. Robert Dauffenbach of Oklahoma State University, Stillwater, OK., said the economic status of America has been characterized as STAG/HIGH during 1985 and 1986. However, Dr. Dauffenbach stated that "the economy will be 70% stronger in 1987, than it was in 1986." He calls the 1987 economy a "bullish economy." His explanation is that the economy in 1986 was less than vibrant; therefore, there are a great deal of unused resources available to industry. A healthy economy could spur industry to press currently unemployed S/E into service. He cited the shortfall that business and industry can make up as having been created by (a) the weakened dollar, (b) the loss of manufactured exports, and (c) the bullish Wall Street stock market. These conditions, which can positively affect business and industry, can create new jobs for scientists and engineers.

He sees such stimuli as (a) physical scientists' employment up in business and industry, (b) academic research and development on the increase (c) defense expenditures up by 7% in real dollars (d) industrial companies increasing their funding by 9% in real dollars, and (e) a 6% increase in research and development in real terms for industrial upgrading.

On the other hand, he is quick to remind us of the importance of realizing that projections are not predictions, and that there are methodological limitations to simulation models. The NSF sends out quick response surveys almost monthly to keep abreast of the real situation in terms of Supply and Demand of S/E.

LABOR SUPPLY AND DEMAND MODEL

Maintaining a balanced society, with a healthy economy and a low unemployment rate, requires the proper mix of supply and demand of scientists, engineers and technicians. The equation, Demand - Supply = 0, (where there is low unemployment), is the focus of this chapter.

The National Science Foundation (NSF) has been mandated by Congress to keep track of America's supply of scientists, engineers and technicians (SET).

The National Science Foundation has a special preference for the Dauffenbach/Fiorito/Folk (DFF) model which is the most comprehensive model of S/E labor supply available. The supply system of S/E personnel depicted by the model consists of four major distinct, but related, components including; (1) the existing stock of S/E personnel; (2) flows of new entrants to S/E occupations; (3) flows of experienced workers into, among, and out of S/E occupations; and, (4) international flows of S/E workers, (see Chart VIa). The DFF model depicts the supply system for S/E personnel in 21 occupational categories including computer specialties (systems analysis and programming), engineering, and mathematical, physical, and social sciences. For each occupation, the model determines the supply of personnel in any given year from the supply in the preceding year adjusted to account for the net effect of worker flows into and out of that occupation.

Persons output are those lost from the pool by death, retirement and transfer out of the profession. We will limit our findings by looking only at the input because the output is a negligible fraction of input.

The model points to the behavior that governs S/E personnel flows. These flows describe changes in supply that relate to three types of workers: New labor force entrants, experienced workers, and immigrants. New labor force entrants are those who have recently graduated and are pursuing full-time S/E employment. Occupational mobility of the experienced work force is incorporated into the DFF model through estimates of personnel flows into, among, and out of S/E occupations; also included are flows out of the labor force that result from deaths and retirements. Experienced worker behavior in the model is determined primarily by job opportunities across various occupations as well as occupation-specific characteristics. The third category of workers affecting supply is immigrants, whose behavior is affected by labor market conditions and immigration laws.

The market conditions used to drive the model were based on the four macroeconomic/defense-expenditures scenarios previously described; each projection scenario generating its own supply response. Implicit to these simulations was the assumption that transfers into and out of S/E occupations by the experienced work force were equal. These simulations provided worst-case scenarios and were used to highlight those occupations most sensitive to supply shortages.

Source: NSF: Projected response the science, engineering, and technical labor market to defense and non-defense needs: 1982-87.
NSF: Foreign Citizens in U.S. Science and Engineering: History, Status and Outlook: January 1985.

Betty M. Vetter, editor of The Technical Market: Supply and Demand for Scientists and Engineers, of the Commission on Professionals in Science and Technology, wrote in May 1985:

> Demand for scientists and engineers, either present or future, can be defined in several ways, and no single definition is common across the statistical data-set available. Is present demand exactly equal to the number of persons employed in any particular field? Is demand a combination of the number employed plus the number of unfilled openings?
>
> Also uncertain is the most appropriate method for assessment of imbalance between supply and demand. Would supply and demand be in perfect balance if the unemployment rate among scientists and engineers were zero and all authorized positions were filled? If supply and demand are out of balance, is the problem one of oversupply of scientists and engineers, undersupply of science and engineering employment, or a combination of both which varies by science or engineering field?
>
> The problem of determining balance in supply and demand is compounded by the fact that there are different markets for experienced and inexperienced scientists and engineers. These two markets operate differently and often independently, employing different recruitment methods and different employment techniques. It is not uncommon for a company to be actively recruiting new science and engineering graduates even as they are laying off some experienced scientists and engineers. Among the principal reasons for this dichotomy is that different kinds of jobs are involved in the two markets.
>
> New scientists or engineers are needed for entry level positions with high technical content, and for management training. Openings for experienced engineers and scientists usually are more specific in terms of job requirements, particularly on the technical side. Older scientists and engineers sought for management positions may be required to have extensive experience in a particular industry or product area.
>
> Demand for Experienced S/E Professions
>
> Employment of experienced scientists and engineers as well as other professionals is measured by the Bureau of Labor Statistics in its monthly surveys of about 40,000 households, but the figures are aggregated into the category of "professional and technical workers" which includes many persons who are not scientists and engineers. Engineering employment and unemployment is calculated quarterly from this BLS survey.
>
> Another comparative index of demand for scientists and engineers is the High Technology Recruitment Index

maintained by Deutsch, Shea and Evans. This index measures classified advertising for scientists and engineers in newspaper display ads, newspaper classified ads and technological journals. On an annual basis, the Index averaged 133 in 1984, well above the base year norm of 100 and the 1983 annual average of 101.

Academic Demand

The number of scientists and engineers employed full time at colleges and universities increased 26% during the years from 1975 to 1984, rising from a total of 223,336 in January 1975 to 281,561 in January 1984, according to surveys by the National Science Foundation.

Engineering Faculty

There is a shortage of faculty in engineering and in computer science. There are now an estimated 18,440 authorized faculty positions in U.S. engineering schools, with an estimated 1,570 vacancies.

The 1982 survey found that 18% of all full-time engineering faculty members did not receive their B.S. degrees from an institution in the U.S., and over 13% received their PhD. from the institution at which they are now employed. The highest percentage of foreign born faculty is in computer science/engineering - 20.7%. Additionally, some engineers already on university faculties have been lured away by higher salaries and better equipment for research in industry, and by increased teaching loads and fewer graduate assistants in academe.

1985 NSF SCIENCE AND ENGINEERING LABOR MARKET STUDY

Excerpts from the above article have been presented in it's original format.

For the past several years, the National Science Foundation has conducted annual surveys of U.S. industry to monitor the adequacy of the supply of scientific, engineering and technician (SET) personnel. Although the economy has had only moderate growth for over a year, the proportion of surveyed employers reporting personnel shortages has remained fairly stable. Approximately one-fourth (28 percent) of the 290 private industry respondents surveyed in 1985 reported shortages in at least one SET field. This is approximately the same level as reported in the 1983 and 1984 surveys (1983: 29%, 1984: 33%), but is below that of 1981 when 60 percent of the surveyed employers reported shortages.

Shortages by Occupation for 1984-85

As was the case a year earlier, the shortages in 1985 were concentrated in engineering fields, particularly electronics, electrical and nuclear engineering:

Table 1

SET Fields with the Highest Levels of Reported Shortages

SET Field	1985 Recruiting Period %	Base: Employers	1984 Recruiting Period %	Base: Employers
Electronics engineering	17	(88)	12	(105)
Nuclear engineering	17	(23)	12	(17)
Electrical engineering	16	(175)	19	(209)
Aeronautical/astronautical engineering	11	(19)	8	(26)
Manufacturing engineering	10	(74)	7	(107)
Computer engineering	9	(76)	15	(102)

Table 2

Employers Reporting Growth in Demand for SET Personnel Over the Previous Recruiting Year by Industry

Industry	1985 Recruiting Period %	Base: Employers	1984 Recruiting Period %	Base: Employers
Engineering/architectural services	45	(20)	75	(8)
Machinery/transportation equipment	37	(35)	34	(35)
Petroleum refining/extraction	35	(23)	23	(30)
Office equipment/computers	32	(41)	45	(29)
Utilities	30	(20)	17	(24)
Mining	27	(15)	7	(14)
Chemicals/drugs	25	(40)	52	(52)
Primary and fabricated metals	20	(30)	23	(39)
Electrical machinery/communications equipment	17	(23)	40	(35)
Commercial R&D labs	17	(18)	--	--

Table 3

Defense Employers Reporting Shortages in at Least One SET Field

	1985 Recruiting Period %	Base: Employers	1984 Recruiting Period %	Base: Employers
Defense-related firms	50	(42)	64	(42)
Nondefense-related firms	24	(236)	27	(263)

Table 4

Defense Employers Reporting Growth in Demand for SET Personnel Over Previous Recruiting Year

	1985 Recruiting Period %	Base: Employers	1984 Recruiting Period %	Base: Employers
Defense-related firms	48	(42)	51	(41)
Nondefense-related firms	29	(234)	34	(258)

---

[2] Defense firms are defined as those firms reporting at least 10% of their SET workforce as being engaged in defense-related work.

Defense-related work involved more than 10 percent of the SET workforce for responding firms in the following industries: aircraft/aerospace (75% of firms); engineering/architectural services (50%); electrical machinery/communications equipment (27%); and office equipment/computer (26%). Overall, the greater the proportion of a firm's SET labor force engaged in defense-related activity in 1985, the greater was the difference from the average industrial pattern for employment shortages and the growth in vacancies.

Recruiting problems for defense-related firms hiring electrical engineers improved over 1984, but remained about the same for employers of electronics and computer engineers:

Table 5

Defense Employers Reporting Shortages in High Shortage SET Fields

	1985 Recruiting Period %	Base: Employers	1984 Recruiting Period %	Base: Employers
Electrical engineering	36	(28)	45	(64)
Electronics engineering	30	(20)	27	(40)
Computer engineering	25	(12)	25	(43)

VII. Employer Reports about Quality of SET Hires

Respondents who were knowledgeable about their firm's college recruiting in recent years were asked their opinions about the quality of academic preparation of recent college graduate applicants for science and engineering jobs.

Table 6

Relative Shortage of Scientists, Engineers and Technicians (SET) Personnel, October 1985 and Projected Relative Demand for 1986,

Engineers	Relative Shortage 1985*	Shortage Compared to 1984	Projected Hiring for 1986**	Shortage Assessment for 1986***
Aeronautical/ astronautical	High	Up	Average	Possible shortage
Chemical	Low	Same	Low	No shortage
Civil	Low	Down	Low	No shortage
Computer	Average	Down	High	No shortage
Electrical	High	Down	High	Possible shortage
Electronic	High	Up	High	Shortage
General	Low	Same	High	No shortage
Industrial	Low	Up	Average	No shortage
Manufacturing	High	Up	High	Shortage
Mechanical	Average	Average	Average	No shortage
Metallurgical	Low	Down	Low	No shortage
Mining	Average	Up	Low	No Shortage
Nuclear	High	Up	Average	Possible shortage
Petroleum	Low	Down	Average	No shortage
Sales	Low	Same	High	No shortage
Scientists				
Biologists	Low	Down	High	No shortage
Biochemists	Average	Up	Average	No shortage
Chemists	Low	Down	Average	No shortage
Computer scientists	Average	Down	High	No shortage
Computer systems analysts	Average	Up	Average	No shortage
Geologists/geophysicists	Low	Down	Average	No shortage
Mathematicians	Low	Up	Low	No shortage
Physicists	Low	Down	Average	No shortage

Table 6 (cont.)

Relative Shortage of Scientists, Engineers
and Technicians (SET) Personnel, October 1985
and Projected Relative Demand for 1986

Technicians	Relative Shortage 1985*	Shortage Compared to 1984	Projected Hiring for 1986**	Shortage Assessment for 1986***
Biological	Low	Down	High	No shortage
Civil engineering	Low	Up	High	No shortage
Computer programmers	Low	Up	Average	No shortage
Drafters	Low	Up	Average	No shortage
Electrical/electronic engineering	Average	Up	High	Possible shortage
Industrial engineering	Average	Up	Average	No shortage
Mechanical engineering	Average	Up	Average	No shortage
Tool programmers	Low	Same	High	No shortage

*The average proportion of employers of a SET field reporting shortage is 5.0 percent. "Average relative shortage" is defined as between 5 percent and 9 percent, "high" as 10 percent and over, and "low" as under 5 percent.

**The average ratio of projected hires to current employment by field is 9.0 percent. "Average projected hiring" is defined as between 5 percent and 9 percent, "high" as 10 percent and over, and "low" as under 5 percent.

***This assessment is based on the combination of ratings for "Relative Shortage for 1985," "Shortage Compared to 1984" and "Projected Hiring for 1986," e.g.:

		Relative Shortage 1985	Shortage Compared to 1984	Projected Hiring for 1986
Shortage	=	High	Up	High
Possible shortage	=	Average	Up	High
		High	Down	High
		High	Up	Average
No shortage	=	All other combinations		

Projected hiring for each SET field was determined by calculating the ratio of planned new hires to current employment levels in a field; assessments for shortages in 1986 were derived by jointly analyzing relative shortage in 1985, 1985 shortage compared to 1984 and projected hiring for fields. Nearly all of the current leading shortage fields demonstrate high projected hiring demand for 1986, in addition to several other SET fields including manufacturing, general and sales engineering; and computer science. Significant shortages are expected to continue for electronics and manufacturing engineers. Additionally, it is possible shortage conditions will continue for aeronautical/astronautical, electrical and nuclear engineers. Hiring is projected to be high for the following technical fields including biological science, civil, electrical/electronics and tool programmer engineering technicians, and shortages are expected to continue for electrical/electronics engineering technicians.

PROJECTIONS OF SUPPLY AND DEMAND

Estimates of long range future demand usually are either projections based on past trends which incorporate certain demographic statistics, or surveys based on the hiring plans of major employers.

The accuracy of the forecast is, of course, dependent on the accuracy of the assumptions made in regard to the change or stability of conditions that affect demand. For this reason, many forecasters utilize more than one "scenario" to describe the expected range of changes.

The National Science Foundation has provided an examination of supply and demand in science and engineering that compares 1983 with 1987 and is presented in the chart below.

SUPPLY/DEMAND BALANCE OF SCIENTISTS AND ENGINEERS BASED ON A NET-MOBILITY SUPPLY MODEL, 1983 AND 1987

OCCUPATION	1983				1987			
	TOTAL SUPPLY	NEW ENTRANTS	DEMAND	BALANCE AS PERCENT OF SUPPLY	TOTAL SUPPLY	NEW ENTRANTS	DEMAND	BALANCE AS PERCENT OF SUPPLY
				(In thousands)				
Total Scientists	566.2	87.0	523.0	7.7	639.9	92.2	584.7	8.6
Agricultural Scientists	20.8	5.3	17.6	15.4	22.2	5.0	18.4	17.1
Biologists	67.6	19.2	56.7	16.1	76.3	19.7	62.5	18.1
Chemists	95.5	6.1	93.9	1.7	104.6	6.4	102.8	1.7
Geologists	45.7	4.4	42.5	7.0	51.6	4.9	47.9	7.2
Mathematical Scientists	55.3	5.8	53.0	4.2	63.0	5.9	60.6	3.8
Physicists	23.6	2.9	21.7	8.1	26.6	3.1	24.2	9.0
Other Life & Physical Scientists	30.1	1.9	28.6	5.0	33.3	2.0	31.3	6.0
Social Scientists	227.6	41.4	209.0	8.2	262.3	45.2	237.0	9.6
Economists	34.7	7.5	31.4	9.5	40.7	8.2	36.2	11.1
Psychologists	98.4	12.9	92.7	5.8	113.6	14.3	106.2	6.5
Sociologists	12.5	6.1	9.6	23.2	25.2	7.3	10.7	29.6
Social, n.e.c.	82.0	14.9	75.3	8.2	92.8	15.4	83.9	9.6
Total Engineers	1,217.2	64.0	1,207.6	0.8	1,437.3	66.8	1,423.1	1.0
Aero/Astronautical	70.0	1.9	72.4	-3.4	104.8	2.2	109.2	-4.2
Chemical	58.0	5.5	55.4	4.5	64.2	5.4	60.9	5.1
Civil	171.6	10.2	171.5	0.1	190.1	10.2	188.9	0.6
Electrical/Electronic	347.9	14.0	348.9	-0.3	421.3	15.6	420.6	0.2
Industrial	114.2	4.0	114.9	-0.6	129.8	4.1	130.8	-0.8
Mechanical	217.9	11.4	214.3	1.7	253.4	11.7	248.2	2.1
Metallurgical	16.3	1.4	15.8	3.1	19.2	1.4	18.5	3.6
Mining/Petroleum	28.5	2.1	27.6	3.2	32.5	2.3	31.6	2.8
Engineers, n.e.c.	192.8	13.5	186.8	3.1	222.0	13.9	214.4	3.4
Computer Specialists*	477.7	10.8	486.9	-1.9	592.8	13.5	603.6	-1.9

* Includes both computer systems analysts and computer programmers

Note: This projection is based on the high-economic growth and high-defense expenditure scenario.
Because of rounding, components may not correspond to totals.

Source: National Science Foundation

Projected Labor Market Conditions For 1987

From the NSF Projected Response of the Science, Engineering and Technical Labor Market to Defense and Non-defense Needs: 1982-1987

Two concepts of labor market shortages are used in this analysis. The first concept deals with personnel shortages. These shortages are derived from the worst-case supply scenarios that assume all labor market adjustments were made through new labor force entrants and immigrants. It should be remembered that this analysis assumes that there was no net contribution to supply resulting from occupational mobility of the experienced work force.

The first assumption is that shortfalls in projected supply of up to 5 percent would be tolerated as being sufficiently small so that nominal market adjustments could easily accomodate them. Occupations in which projected supply falls short of demand within the 5-percent to 10-percent range is considered to be of some concern with respect to the ability of the market to adjust by providing adequate numbers of personnel and personnel of suitable training and experience. Finally, if projected supply falls short of demand in an occupation by more than 10 percent, and if this shortfall is expected to be sustained, a serious shortage situation is indicated.

Despite the forced inflexibility of labor supply in these scenarios, the overall supply of S/E personnel is more than adequate to meet both growth in requirements and the replacement needs resulting from deaths and retirements. All science occupations show substantial personnel surpluses in 1987. Engineering occupations are in balance, however, although some specialties are projected to have shortages of personnel. Shortages are indicated for both aeronautical/astronautical and electrical/electronic engineering occupations.

Over a relatively short period of time, S/E labor market adjustments are achieved primarily through occupational mobility and, to a lesser extent, through the increased use of S/E college graduates and immigrants. The Dauffenbach/Fiorito/Folk (DFF) model provides valuable insight into the magnitude and, hence, feasibility of projected adjustments that must be made within the S/E labor market to meet both growth and replacement needs.

Projected Shortage Fields, 1987

The greatest shortage of engineers was in Aeronautical/astronautical engineers. Employment in this engineering specialty was projected to increase at an average annual rate ranging from 5.9 percent to 11.1 percent between 1982 and 1987. Growth in this occupation is expected to outpace additions to supply from new entrants and immigrants, indicating a shortage situation regardless of the levels of defense and nondefense demand being simulated. While available supply of personnel in this occupation appeared to exceed demand in 1982, by 1987 shortages are projected to range from 15 percent in STAG/LOW to 45 percent in OPTIM/HIGH, suggesting the need for an additional 10,000 to 35,000 personnel.

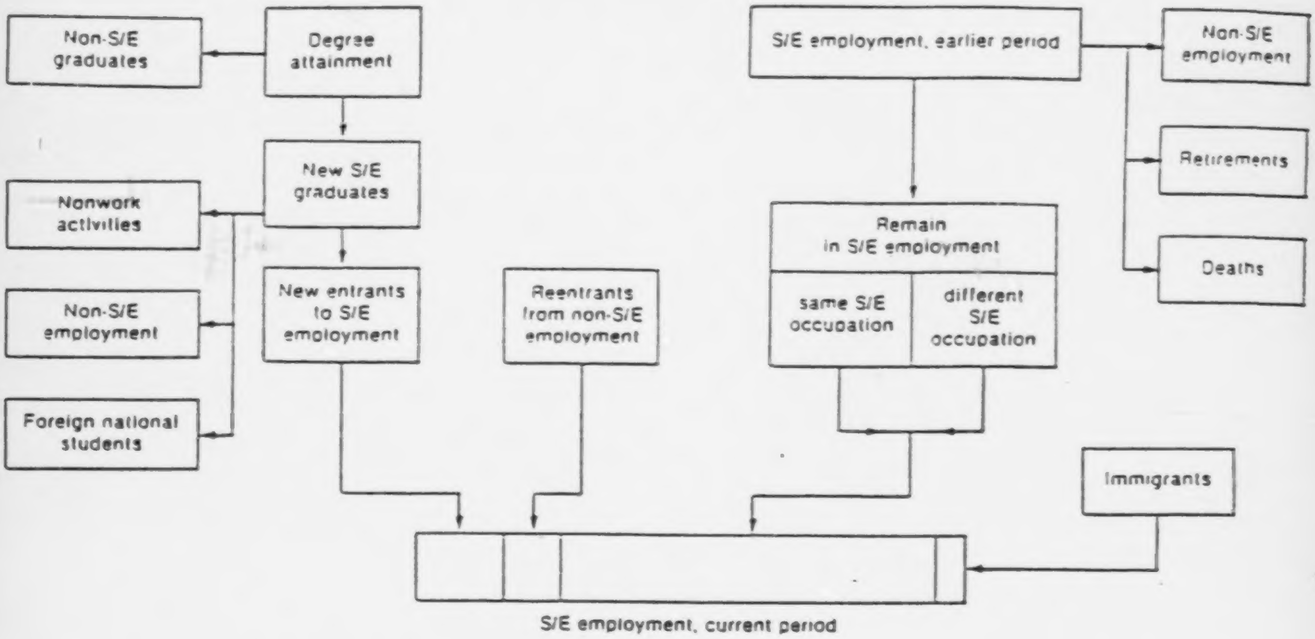
Occupational mobility within the experienced work force can also be expected to alleviate potential personnel shortages when inadequate numbers of new labor force entrants and immigrants are available to meet both growth and replacement needs. When mobility is taken into account, potential shortages decline dramatically. For the STAG/LOW and OPTIM/HIGH scenarios, the shortage of aeronautical/astronautical engineers in 1987 ranges from 2.3 percent to 4.2 percent of supply and represents only 2,000 to 4,500 personnel. In that year projected supply growth under the STAG/LOW scenario is comprised of roughly 9,000 experienced workers entering from other occupations, 2,000 new entrants, and 100 immigrants.

CONCLUSIONS

Despite the high levels of skill required in these fields, labor market adjustments ae likely to be made, even over a relatively short 5-year period, moderating identifiable personnel shortages that could potentially be manifested as job vacancies. The process by which the labor market equilibrates demand and supply, however, can be expected to have an impact on the quality of the S/E work force. The larger the required adjustment, the more likely it is that employers would be forced to hire idividuals with inappropriate training and/or experience. Such quality downgrading is, itself, a manifestation of labor market imbalance and can impose very real costs not only in terms of employer-supplied training, but more importantly in terms of productivity and quality losses. These effects can significantly hinder national programs such as the defense buildup. Finally, the costs of current market adjustments can have an impact on future S/E labor supply if the academic sector fails to retain graduate students or current faculty.

Source: The NSF Projected Response of the Science, Engineering and Technical Labor Market to Defense and Non-Defense Needs: 1982-1987.

Chart V.1.a **Schematic diagram of the science and engineering (S/E) DauffenBach/Fiorito/Folk labor supply model**


Non-S/E graduates
Degree attainment
New S/E graduates
Nonwork activities
Non-S/E employment
Foreign national students
New entrants to S/E employment
Reentrants from non-S/E employment
S/E employment, earlier period
Non-S/E employment
Retirements
Deaths
Remain in S/E employment
same S/E occupation
different S/E occupation
Immigrants
S/E employment, current period

SOURCE: Robert C. DauffenBach and Jack Fiorito, Oklahoma State University

Chart V.2.a **Projected range of employment in science, engineering, and technician occupations: 1982-87**

(In thousands)

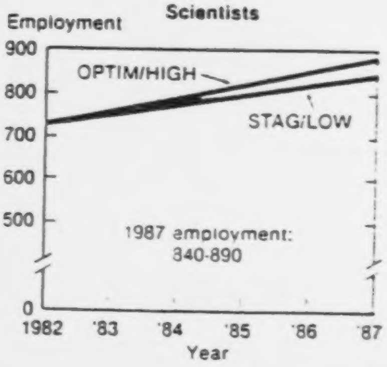
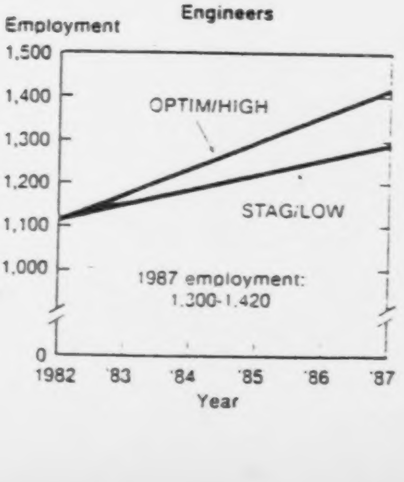


Chart V.3.a **Projected range of employment in science, engineering, and technician occupations: 1982-87**

(In thousands)



Source: NSF 84-330

Table 5.1

Summary table of U.S. economy: 1982-87—STAG/HIGH

Macroeconomic indicators	1982	1983	1984	1985	1986	1987
	Gross national product (GNP) [In billions]					
GNP	$3,066.3	$3,325.9	$3,655.2	$4,403.1	$4,429.4	$4,822.5
Real GNP, 1972 dollars	1,486.1	1,508.6	1,539.5	1,575.1	1,614.3	1,654.6
Annual rate of change	-1.6	1.5	2.0	2.3	2.5	2.5
	Defense expenditures [In billions]					
Purchases	$179.4	$216.2	$256.1	$303.7	$349.5	$389.9
Real purchases, 1972 dollars	78.8	87.4	95.0	103.6	111.0	116.1
Annual rate of change	6.6	11.0	8.6	9.1	7.1	4.6
Prime contracts	128.2	145.9	174.9	203.6	233.1	259.8
Price deflator, annual rate of change	9.2	8.5	9.1	8.7	7.5	6.7
	Prices, wages, productivity—annual rates of change [Percent]					
GNP deflator	6.5	6.8	7.7	8.1	6.9	6.2
Consumer price index	6.2	7.3	7.9	8.4	6.9	6.3
Compensation per hour	7.2	7.5	8.4	9.3	9.0	8.3
Output per hour	-.4	1.4	.6	1.6	1.3	.9
	Labor force [In millions]					
Military personnel	2.1	2.2	2.2	2.2	2.3	2.3
Civilian labor force	110.2	112.4	114.4	115.9	117.5	119.1
Employment	100.0	102.2	104.0	104.4	105.3	106.5
Unemployment rate	9.2	9.1	9.1	9.9	10.4	10.6
	Industrial production					
Industrial production index (1967 = 1.0)	1.399	1.432	1.478	1.539	1.579	1.620
Annual rate of change	-7.3	2.4	3.2	4.1	2.6	2.6
Manufacturing industries:						
Production, annual rate of change	-7.8	2.8	3.4	4.3	3.0	2.8
Capacity utilization rate	71.3	72.7	73.7	73.3	74.8	76.2

NOTES: STAG/HIGH indicates low-economic growth/high-defense expenditure scenario. Projection scenarios were derived using the Defense Interindustry Forecasting System developed by Data Resources, Incorporated (DRI).

Source: National Science Foundation
NSF 84-304

Table 5.2

Projected growth in defense and nondefense requirements of scientists, engineers, and technicians: 1982-87—STAG/HIGH

[In thousands]

Occupation	Total requirements			Defense requirements			Nondefense requirements		
	1982	1987	Annual growth rate	1982	1987	Annual growth rate	1982	1987	Annual growth rate
Total scientists	726.9	862.1	3.5	%22.0	33.2	8.6	%704.9	828.6	3.2%
Computer systems analysts	219.3	294.7	6.1	10.0	17.6	12.0	209.1	277.0	5.8
Life:									
Agricultural	17.2	17.5	.3	.1	.1	.0	17.0	17.4	.5
Biologists	55.3	60.4	1.8	.7	.8	2.7	54.7	59.5	1.7
Physical:									
Chemists	90.7	99.6	1.9	2.9	3.7	5.0	87.9	95.9	1.8
Geologists	42.7	48.2	2.4	1.1	1.3	3.4	41.7	46.9	2.4
Physicists	20.9	23.4	2.3	1.1	1.6	7.9	19.8	21.8	1.9
Life/physical, n.e.c.	27.6	30.4	2.0	.7	1.0	7.4	26.9	29.4	1.8
Mathematical	51.0	58.7	2.8	2.4	3.3	6.6	48.6	55.4	2.6
Social	202.2	229.2	2.5	3.0	3.8	4.8	199.2	225.3	2.5
Economists	30.3	35.3	3.1	.8	1.2	8.4	29.5	34.1	2.9
Psychologists	90.4	101.7	2.4	1.0	1.0	.0	89.4	100.6	2.4
Sociologists	9.3	10.3	2.1	.1	.1	.0	9.2	10.2	2.1
Social, n.e.c.	72.2	81.9	2.6	1.1	1.5	6.4	71.1	80.4	2.5
Total engineers	1,140.3	1,373.2	3.8	139.2	223.6	9.9	1,001.0	1,149.7	2.8
Aeronautical/astronautical	64.5	107.2	10.7	33.7	64.8	14.0	30.8	42.4	6.6
Chemical	53.1	58.7	2.0	2.6	3.4	5.5	50.6	55.4	1.8
Civil	163.5	179.1	1.8	3.4	4.3	4.8	160.1	174.9	1.8
Electrical/electronic	327.6	415.2	4.8	41.3	63.7	9.0	286.2	351.4	4.2
Industrial	109.3	125.0	2.7	9.7	14.5	8.4	99.6	110.5	2.1
Mechanical	202.2	233.4	2.9	18.9	28.8	8.8	183.2	204.6	2.2
Metallurgical	14.8	17.1	2.9	1.4	2.2	9.5	13.4	14.9	2.1
Mining/petroleum	27.6	31.8	2.9	.9	1.1	4.0	26.7	30.7	2.8
Engineers, n.e.c.	177.7	205.7	3.0	27.3	40.8	8.4	150.4	164.9	1.8
Total technicians	1,466.4	1,694.2	2.9	83.9	120.4	7.5	1,382.5	1,573.9	2.6
Computer programmers	235.1	294.4	4.6	9.6	14.2	8.1	225.5	280.2	4.4
Drafters	312.2	347.5	2.2	17.2	22.6	5.6	295.0	324.8	1.9
Electrical/electronic engineering	345.5	410.2	3.5	28.7	42.7	8.3	316.8	367.6	3.0
Industrial engineering	30.5	34.6	2.6	2.3	3.2	6.8	28.2	31.4	2.2
Mechanical engineering	44.8	54.6	4.0	8.4	13.0	9.1	36.4	41.6	2.7
Science/engineering, n.e.c.	498.3	552.9	2.1	17.7	24.7	6.9	480.6	528.3	1.9

NOTES: STAG/HIGH indicates low-economic growth/high-defense expenditure scenario. Because of rounding, components may not add to totals.

Source: National Science Foundation
NSF 84-304

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Table 5.3

Supply/demand balance of scientists and engineers based on net-mobility supply model: 1983 and 1987—STAG/HIGH

[In thousands]

Occupation	1983				1987			
	Supply	Demand	Balance surplus (+)/ shortage (-)	Balance as percent of supply	Supply	Demand	Balance surplus (+)/ shortage(-)	Balance as percent of supply
Total scientists	557.5	507.6	49.9	9.0	607.5	567.4	40.1	36.6
Agricultural	20.7	17.2	3.5	16.9	21.3	17.5	3.7	17.4
Biologists	66.8	55.3	11.5	17.2	72.6	60.4	12.2	16.8
Chemists	94.4	90.7	3.7	3.9	99.7	99.6	.1	.0
Geologists	45.3	42.7	2.6	5.7	50.1	48.2	1.9	3.8
Mathematical	54.3	51.0	3.3	6.1	59.5	58.7	.8	1.3
Physicists	23.1	20.9	2.2	9.5	25.1	23.4	1.7	6.8
Other life and physical	29.7	27.6	2.1	7.1	31.7	30.4	1.3	4.1
Social	223.2	202.2	21.0	9.4	247.5	229.2	18.3	7.4
Economists	34.1	30.3	3.8	11.1	38.7	35.3	3.4	8.8
Psychologists	96.5	90.4	6.1	6.3	106.2	101.7	4.5	4.2
Sociologists	12.4	9.3	3.1	25.0	14.4	10.3	3.1	21.5
Social, n.e.c.	80.2	72.2	8.0	10.0	88.2	81.9	6.3	7.1
Total engineers	1,181.5	1,140.3	41.2	3.5	1,343.6	1,373.2	-29.6	2.2
Aeronautical/astronautical	65.1	64.5	.6	.9	94.1	107.2	-13.1	-13.9
Chemical	57.1	53.1	4.0	7.0	60.9	58.7	2.2	3.6
Civil	167.5	163.5	4.0	2.4	176.8	179.1	-2.3	-1.3
Electrical/electronic	334.7	327.6	7.1	2.1	398.8	415.2	-16.4	-4.1
Industrial	111.9	109.3	2.6	2.3	121.9	125.0	-3.1	-2.5
Mechanical	212.3	202.2	10.1	4.8	233.5	233.4	.1	.0
Metallurgical	15.9	14.8	1.1	6.9	17.4	17.1	.3	1.7
Mining/petroleum	28.1	27.6	.5	1.8	31.5	31.8	-.3	.0
Engineers, n.e.c.	188.9	177.7	11.2	5.9	208.7	205.7	3.0	1.4
Computer specialists[1]	456.2	454.3	1.9	-.4	550.6	588.9	-38.3	-7.0

[1] Includes both computer systems analysts and computer programmers

NOTES: STAG/LOW indicates low-economic growth low-defense expenditure scenario. Because of rounding, components may not correspond to totals.

Source: National Science Foundation
NSF 84-304

Table 5.4

Supply/demand balance of scientists and engineers based on net-mobility supply model: 1983 and 1987—OPTIM/HIGH

[In thousands]

Occupation	1983				1987			
	Supply	Demand	Balance surplus (+)/ shortage (-)	Balance as percent of supply	Supply	Demand	Balance surplus (+)/ shortage(-)	Balance as percent of supply
Total scientists	566.2	523.0	43.2	7.7	639.9	584.7	55.2	8.6
Agricultural	20.8	17.6	3.2	15.4	22.2	18.4	3.8	17.1
Biologists	67.6	56.7	10.9	16.1	76.3	62.5	13.8	18.1
Chemists	95.5	93.9	1.6	1.7	104.6	102.8	1.8	1.7
Geologists	45.7	42.5	3.2	7.0	51.6	47.9	3.7	7.2
Mathematical	55.3	53.0	2.3	4.2	63.0	60.6	2.4	3.8
Physicists	23.6	21.7	1.9	8.1	26.6	24.2	2.4	9.0
Other life and physical	30.1	28.6	1.5	5.0	33.3	31.3	2.0	6.0
Social	227.6	209.0	18.6	8.2	262.3	237.0	25.3	9.6
Economists	34.7	31.4	3.3	9.5	40.7	36.2	4.5	11.1
Psychologists	98.4	92.7	5.7	5.8	113.6	106.2	7.4	6.5
Sociologists	12.5	9.6	2.9	23.2	115.2	110.7	4.5	29.6
Social, n.e.c.	82.0	75.3	6.7	8.2	92.8	83.9	8.9	9.6
Total engineers	1,217.2	1,207.6	9.6	.8	1,437.3	1,423.1	14.2	1.0
Aeronautical/ astronautical	70.0	72.4	-2.4	-3.4	104.8	109.2	-4.4	-4.2
Chemical	58.0	55.4	2.6	4.5	64.2	60.9	3.3	5.1
Civil	171.6	171.5	.1	.1	190.1	188.9	1.2	.6
Electrical/electronic	347.9	348.9	-1.0	-.3	421.3	420.6	.7	.2
Industrial	114.2	114.9	-.7	-.6	129.8	130.8	-1.0	-.8
Mechanical	217.9	214.3	3.6	1.7	253.4	248.2	5.2	2.1
Metallurgical	16.3	15.8	.5	3.1	19.2	18.5	.7	3.6
Mining/petroleum	28.5	27.6	.9	3.2	32.5	31.6	.9	2.8
Engineers, n.e.c.	192.8	186.8	6.0	3.1	222.0	214.4	7.6	3.4
Computer specialists[1]	477.7	486.9	-9.2	-1.9	592.8	603.8	-11.0	-1.9

[1] Includes both computer systems analysts and computer programmers.

NOTES: OPTIM/HIGH indicates high-economic growth/high-defense expenditure scenario. Because of rounding, components may not correspond to totals.

Source: National Science Foundation
NSF 84-304

Table 5.5

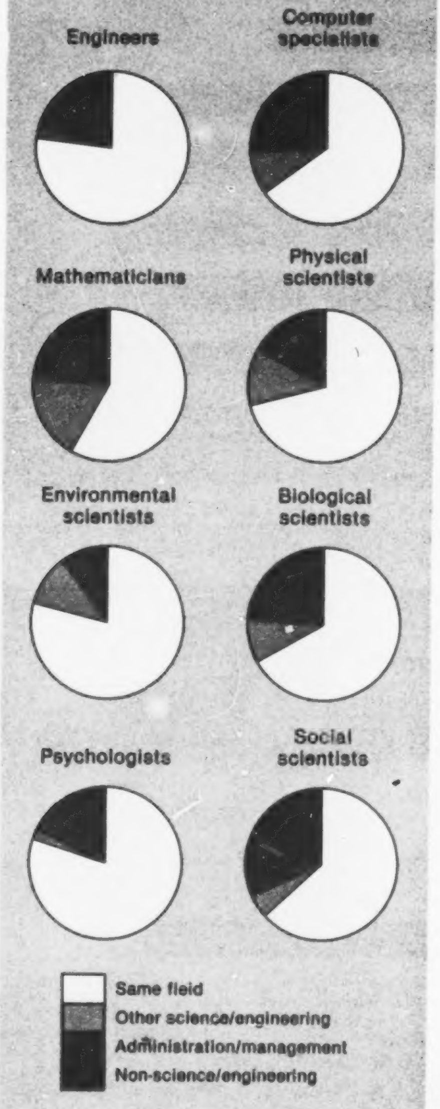
FIELD MOBILITY OF PH.D. SCIENTISTS EMPLOYED FULL-TIME AS CHEMISTS

	FIELD OF HIGHEST DEGREE													
WORK SPECIALTY	Chem. Eng.	Bio-chem.	Gen. Chem.	Analy-tical	Inorg-anic	Organic	Polymer	Pharmac-eutical	Theor-etical	Agricul-tural	Physical	Other	Non-Chemical	TOTAL
Biochemistry	0.0%	66.7%	3.6%	0.7%	0.8%	3.2%	0.8%	4.3%	0.0%	11.3%	2.9%	8.2%	28.4%	10.8%
Agricultural	6.0	6.1	0.0	1.2	0.6	3.7	2.5	6.1	0.0	61.3	0.3	2.2	11.0	3.9
Analytical	2.0	4.4	25.0	74.9	11.1	5.7	1.7	12.2	6.5	3.8	11.3	13.4	8.3	13.1
Environmental	8.0	2.8	10.7	5.2	5.4	2.4	2.5	1.7	4.3	13.8	4.4	17.9	14.7	4.4
Organic	10.0	2.1	7.1	1.0	4.8	51.6	2.5	7.0	0.0	2.5	1.0	4.5	2.8	21.3
Inorganic	10.0	0.3	7.1	1.7	52.8	1.3	0.8	0.9	0.0	0.0	5.8	3.0	3.7	7.4
Pharmaceutical	4.0	14.1	0.0	4.7	2.0	10.3	2.5	61.7	4.3	2.5	2.8	6.0	9.2	8.7
Physical	10.0	0.2	17.9	3.7	6.3	0.9	2.5	0.9	28.3	1.3	49.8	4.5	2.8	11.0
Theoretical	0.0	0.2	0.0	0.0	0.4	0.3	0.0	0.0	47.8	0.0	2.3	1.5	1.8	1.1
Polymer	38.0	0.9	14.3	1.7	6.5	15.6	77.5	2.6	6.5	3.8	12.8	3.0	9.2	12.0
Other	12.0	2.3	14.3	5.0	9.3	5.1	6.7	2.6	2.2	0.0	6.5	35.8	8.3	6.3
ALL SPECIALTIES	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

NOTE: Example of how to read this table: 66.7% of those who received their doctorate in biochemistry work as biochemists.

SOURCE: ACS, Salaries 1982.

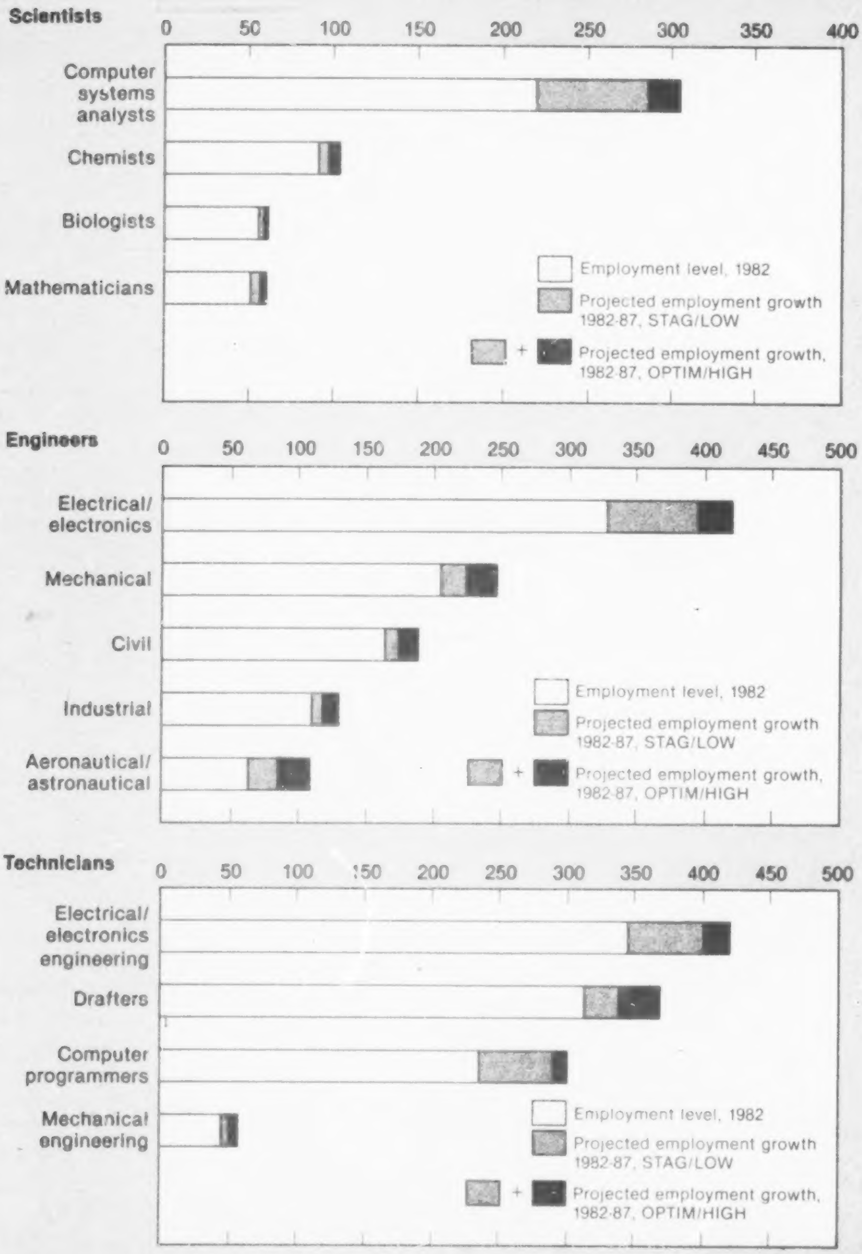
Figure V.1.a Occupational mobility of scientists and engineers: 1972-78



SOURCE: National Science Foundation; appendix table B-34

NSF 85-302

Figure V.2.a **Projected employment in major science, engineering, and technician occupations: 1982-87**

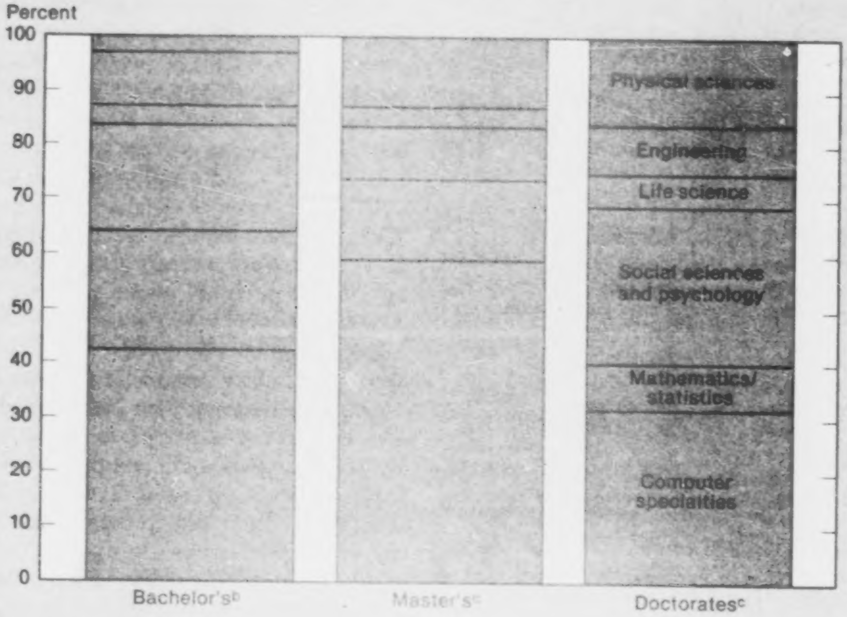


NOTE: STAG/LOW indicates the low-economic growth/low-defense spending scenario and OPTIM/HIGH indicates the high-economic growth/high-defense spending scenario.

SOURCE: National Science Foundation

NSF 84-304

Figure V.3.a Distribution of recent science/engineering degree recipients[a] employed as computer specialists by field and level of degree



[a] Excludes full-time graduate students and those holding postdoctoral appointments.

[b] 1980 graduates in 1982.

[c] 1981/82 graduates in 1983.

NOTE: There were no master's degree recipients in the physical sciences who were working as computer specialists in 1982.

SOURCE: National Science Foundation, appendix table B-33. NSF 84-304

Table 5.6

Projected demand/supply balance in science and engineering occupations: 1987

Occupation	STAG/LOW	OPTIM/HIGH
Scientists		
Agricultural	No shortage	No shortage
Biologists	No shortage	No shortage
Chemists	No shortage	No shortage
Computer specialists[1]	Shortage	Shortage
Geologists	No shortage	No shortage
Mathematicians	No shortage	No shortage
Physicists	No shortage	No shortage
Social	No shortage	No shortage
Engineers		
Aeronautical/astronautical	Shortage	Shortage
Chemical	No shortage	No shortage
Civil	No shortage	No shortage
Electrical/electronic	No shortage	Potential shortage
Industrial	No shortage	No shortage
Mechanical	No shortage	No shortage
Metallurgical	No shortage	No shortage
Mining/petroleum	No shortage	No shortage
Engineering, n.e.c.	No shortage	No shortage

[1] Includes both computer systems analysts and programmers.

NOTES: Shortage occupations have projected supply estimates which deviate from projected demand by 10 percent or more; potential shortage occupations have a projected supply of workers deviating from the projected level of demand by 5 percent to 10 percent.

STAG/LOW indicates the low-economic growth/low defense spending scenario and OPTIM/HIGH indicates the high economic growth/high-defense spending scenario.

Source: National Science Foundation
NSF 84-304

Table 5.7

Transition of recent science and engineering (S/E)-degree recipients from school to work
[In thousands]

Status	Bachelor's[1]	Master's[1]	Doctorates[2]
Population[3]	220	33	17
Labor force	210	32	15
Total employed	198	31	14
Employed in S/E	119	23	13
Employed in non-S/E	79	8	1
Unemployed	12	6	2
Outside the labor force	10	1	1
Full-time graduate students	54	9	—

[1] 1980 graduates in 1982.

[2] 1981-82 graduates in 1983.

[3] Excludes full-time graduate students.

Source: National Science Foundation
NSF 84-304

CHAPTER VI

RESEARCH AND DEVELOPMENT EXPENDITURES

Source: Federal R&D Funding Year 1984
NSF - R&D in Industry, 1984
Federal Support to Universities, Colleges, and Selected Non-Profit Institutions - FY 1984.

CHAPTER VI- RESEARCH AND DEVELOPMENT EXPENDITURES

OVERVIEW

Total budget authority for all R&D programs, as proposed in the 1987 Federal budget, is $61,489 million, 15 percent, or $8,254 million higher than the 1986 total of $53,235 million.

The 1987 budget continues to place high priority on research and development as being relevant to the Nation's long-term well-being.

At the same time, the 1987 budget continues to propose reductions in R&D programs that are not considered an appropriate Federal responsibility and should be left to the States or the private sector for needed investments.

The leading features of the proposed R&D budget for 1987 are as follows:

- An increase of $8,595 million, or 23 percent in national defense R&D programs in 1987, following a 9 percent increase in 1986.
- A decrease of $341 million, or 2 percent, for all of the non-defense functions combined, compared with a 1 percent gain in 1986.
- A decrease of $34 million, or almost 1 percent, in health R&D activities, following a 1 percent increase in 1986.
- An increase of $364 million, or 13 percent, for space research and technology, following a 6 percent gain in 1986.
- An increase of $263 million, or 14 percent, in general science programs in 1987, following a 1 percent reduction in 1986.
- An increase of $565 million, or 7 percent, for basic research across all functions, following a 3 percent increase in 1986.
- A decrease of $847 million, or 33 percent, in energy R&D programs, compared with an increase of almost 9 percent in 1986.
- An increase of $34 million, or 4 percent, for transportation R&D activities, compared with an 11 percent reduction in 1986.
- A decrease of $123 million, or 12 percent, in natural resources and environment R&D programs, after remaining almost constant in 1986.

R&D budget authority in 1987 is 5.6 percent of total Federal budget authority, compared with 5.0 percent in 1986 and 4.6 percent in 1985.

National Science Foundation

The mathematical and physical sciences (MPS) budget authority for 1987 is $424 million. This represents an increase of 14 percent, or approximately $52 million, above the 1986 level.

Continued emphasis will be placed on the support of graduate students and postdoctorates through the Scientific Research Project Support (SRPS) awards. Chemistry research, which represents one of NSF's principal efforts in biotechnology, is expected to increase 18 percent, or $15 million. The chemistry of life processes effort supports biotechnology-related research in biochemistry, and synthetic and natural products research. Materials research will increase 12 percent, or $12 million, with expansion planned for the Materials Research Groups program.

R&D budget authority for mathematical and physical sciences
(Dollars in millions)

	1985 actual	1986 estimate	1987 estimate
TOTAL	$375	$373	$424
Mathematical sciences	48	50	60
Computer research	32	31	37
Physics	102	102	110
Chemistry	88	86	101
Materials research	106	104	117

In general, research money to chemistry has risen steadily over the past ten years.

In deference to the general trend, the American Association for the Advancement of Science feels that a close vigil is necessary.

AAAS Report IX: Research and Development FY-1985 seemed more critical of the budget cuts that caused a decline in energy and environmental related research and development than for increases in biochemistry and biotechnology. Concerns are highlighted by deficit reductions due to the Gramm Rudman Act. The report stated:

The Major Issues

As we have seen, the most serious issue facing R&D in the FY-1985 budget is its vulnerability to major cutbacks in actions necessary to reduce the deficit. All who recognize the long-term importance of a strong, broad, continuing national effort in R&D will face some difficult strategic decisions when, as is likely, there is a concerted national effort to resize the federal budget to cut back the deficit.

Should the scientific and technical community fight as hard as possible to preserve the preferred treatment R&D had in the FY-1985 budget and let the hurly-burly of the political process determine the results? Or should that community try to help set the priorities for resizing federal support of R&D at a lower level? Should every discipline and field of R&D go out to get all it can in a dog-eat-dog fight with the others or is it to the advantage of all to band together in a unified approach? Is the scientific and technical community capable of organizing itself to prepare its position in advance, or will it react only to a direct threat of imminent action?

These questions deserve careful examination for each of the R&D cutbacks in the FY-1987 budget based on the inappropriateness of federal rather than private or other non-federal support.

Increases in Federal funding for basic research in chemistry has kept pace with overall funding for science, although funding for applied research in chemistry has risen at a below average rate. Funding for chemistry research has risen faster than scientific funding in the industrial and academic sectors over the past decade.

Spending by private industry on research and development is expected to grow by about 5% during 1987 to reach a total of nearly $60 billion, according to a survey by the National Science Foundation of the companies in R&D-intensive industries. This rate is lower than the 13% average annual growth rate of the previous decade. The electrical equipment industry plans the largest annual increase in R&D expenditures - 10%. Other planned increases are machinery (including computers) 7%, chemical 6%, aircraft 6%, instruments 5%, and motor vehicles 4%. Not surprisingly, petroleum firms forecast an 11% decrease in R&D spending.

In the following tables of data on
- (a) Federal funding for basic and applied research including development, they are denoted as F tables
- (b) Industrial research and development funding are denoted as I tables
- (c) Research and development funding at universities and colleges are denoted as C tables

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Source: Federal R&D Funding by Budget Fiscal Years 1985-87. Division of Science Resources Studies, National Science Foundation, March 1986.

Table 6.1.F

AGENCY/FUNCTION CROSSWALK: FISCAL YEARS 1985-87

AGENCIES \ FUNCTIONS	National defense	Health	Space research and technology	Energy	General science	Transportation	Natural resources and environment	Agriculture	International affairs	Veterans benefits and services	Education, training, employment and social services	Commerce and housing credit	Community and regional development	Administration of justice	Income security	General government
Dept of Defense (Mil)	X															
Dept of Hlth & Human Svcs.		X									X					
Dept of Energy	X			X	X											
Nat'l Aeronautics & Space Admin.			X			X										
Nat'l Science Foundation					X											
Dept of Agriculture							X	X								
Dept of Transportation						X										
Dept of Interior							X									
Environmental Protection Agency				X			X									
Dept of Commerce							X					X	X			
Agency for Internat'l Dev.									X							
Veterans Administration										X						
Nuclear Regulatory Commission				X												
Dept of Education											X					
Tennessee Valley Authority													X			
Smithsonian Institution											X					
Dept of Justice														X		
Corp of Engineers-Civil Works							X									
Dept of Housing & Urban Dev.													X			
Dept of Labor		X									X					
Dept of Treasury														X		X
Fed Emergency Management Agency	X															

Source: NSF Unpublished Data

Table 6.2.F SUMMARY OF FEDERAL FUNDS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT: FISCAL YEARS 1985, 1986, AND 1987

(MILLIONS OF DOLLARS)

ITEM	ACTUAL, 1985	ESTIMATES 1986	% CHG 1985-1986	1987	% CHG 1986-1987
TOTAL OUTLAYS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT	45,835.8	49,825.1	8.7%	52,530.0	5.4%
RESEARCH AND DEVELOPMENT	44,146.9	48,107.9	9.0	50,781.9	5.6
R&D PLANT	1,688.9	1,717.2	1.7	1,748.1	1.8
TOTAL OBLIGATIONS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT	50,153.5	53,779.1	7.2	60,919.2	13.3
RESEARCH AND DEVELOPMENT	48,332.3	52,061.8	7.7	59,209.6	13.7
PERFORMERS:					
FEDERAL INTRAMURAL 1/	12,998.4	13,533.4	4.1	15,396.7	13.8
INDUSTRIAL FIRMS	21,985.0	24,899.4	13.3	30,016.0	20.5
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	1,789.3	1,948.5	8.9	1,772.0	-9.1
UNIVERSITIES AND COLLEGES	6,299.0	6,554.7	4.1	6,558.7	.1
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	2,534.5	2,446.2	-3.5	2,712.8	10.9
OTHER NONPROFIT INSTITUTIONS	1,680.1	1,591.5	-5.3	1,580.8	-.7
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	684.9	726.6	6.1	870.5	19.8
STATE AND LOCAL GOVERNMENTS	105.2	103.6	-1.5	82.4	-20.5
FOREIGN	255.9	257.8	.7	219.8	-14.7
RESEARCH	16,130.2	16,454.7	2.0	16,841.1	2.3
PERFORMERS:					
FEDERAL INTRAMURAL 1/	5,109.3	5,108.0	*	5,330.3	4.4
INDUSTRIAL FIRMS	2,168.6	2,357.7	8.7	2,559.1	8.5
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	490.0	491.7	.4	447.2	-9.1
UNIVERSITIES AND COLLEGES	5,673.2	5,908.9	4.2	5,842.1	-1.1
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	1,335.9	1,252.7	-6.2	1,354.5	8.1
OTHER NONPROFIT INSTITUTIONS	1,025.5	1,029.3	.4	1,030.9	.2
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	93.0	89.9	-3.3	84.4	-6.1
STATE AND LOCAL GOVERNMENTS	87.7	85.3	-2.7	69.3	-18.8
FOREIGN	147.1	131.2	-10.8	123.3	-6.0
FIELDS OF SCIENCE:					
LIFE SCIENCES	6,366.2	6,457.6	1.4	6,289.3	-2.6
PSYCHOLOGY	319.0	326.2	2.2	318.4	-2.4
PHYSICAL SCIENCES	3,044.1	3,071.8	.9	3,300.3	7.4
ENVIRONMENTAL SCIENCES	1,403.6	1,458.2	3.9	1,483.4	1.7
MATHEMATICS AND COMPUTER SCIENCES	577.5	665.0	15.2	759.0	14.1
ENGINEERING	3,628.5	3,684.4	1.5	3,857.8	4.7
SOCIAL SCIENCES	462.4	434.6	-6.0	460.2	5.9
OTHER SCIENCES, NEC	328.8	356.9	8.5	372.8	4.5
BASIC RESEARCH	7,818.7	8,145.1	4.2	8,347.7	2.5
PERFORMERS:					
FEDERAL INTRAMURAL 1/	1,961.0	1,999.5	2.0	2,022.5	1.1
INDUSTRIAL FIRMS	403.8	476.6	18.0	549.6	15.3
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	114.8	119.5	4.1	126.4	5.8
UNIVERSITIES AND COLLEGES	4,018.3	4,228.2	5.2	4,246.9	.4
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	695.3	689.7	-.8	779.5	13.0
OTHER NONPROFIT INSTITUTIONS	550.1	552.9	.5	550.0	-.5
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	12.4	14.7	18.4	13.8	-6.0
STATE AND LOCAL GOVERNMENTS	31.7	32.1	1.3	30.6	-4.7
FOREIGN	31.2	32.0	2.4	28.5	-11.0
FIELDS OF SCIENCE:					
LIFE SCIENCES	3,807.5	3,902.1	2.5	3,760.9	-3.6
PSYCHOLOGY	130.1	138.5	6.4	134.3	-3.0
PHYSICAL SCIENCES	1,814.0	1,901.8	4.8	2,141.0	12.6
ENVIRONMENTAL SCIENCES	699.7	747.3	6.8	795.8	6.5
MATHEMATICS AND COMPUTER SCIENCES	260.6	298.7	14.6	295.4	-1.1
ENGINEERING	886.8	945.1	6.6	989.9	4.7
SOCIAL SCIENCES	141.2	131.3	-7.0	137.5	4.7
OTHER SCIENCES, NEC	78.7	80.5	2.2	92.9	15.4
APPLIED RESEARCH	8,311.5	8,309.6	*	8,493.4	2.2
PERFORMERS:					
FEDERAL INTRAMURAL 1/	3,148.3	3,108.5	-1.3	3,307.8	6.4
INDUSTRIAL FIRMS	1,764.7	1,881.0	6.6	2,009.6	6.8
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	375.2	372.2	-.8	320.8	-13.8
UNIVERSITIES AND COLLEGES	1,654.9	1,680.7	1.6	1,595.2	-5.1
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	640.5	563.0	-12.1	575.0	2.1
OTHER NONPROFIT INSTITUTIONS	475.5	476.4	.2	480.9	.9
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	80.6	75.2	-6.7	70.7	-6.1
STATE AND LOCAL GOVERNMENTS	56.0	53.2	-5.0	38.7	-27.3
FOREIGN	115.8	99.2	-14.4	94.8	-4.4
FIELDS OF SCIENCE:					
LIFE SCIENCES	2,558.7	2,555.5	-.1	2,528.4	-1.1
PSYCHOLOGY	188.9	187.7	-.7	184.1	-1.9
PHYSICAL SCIENCES	1,230.1	1,170.0	-4.9	1,159.3	-.9
ENVIRONMENTAL SCIENCES	703.9	710.9	1.0	687.6	-3.3
MATHEMATICS AND COMPUTER SCIENCES	316.9	366.3	15.6	463.5	26.5
ENGINEERING	2,741.7	2,739.4	-.1	2,867.9	4.7
SOCIAL SCIENCES	321.2	303.3	-5.6%	322.7	6.4%
OTHER SCIENCES, NEC	250.1	276.4	10.5	279.9	1.3

Table 6.2.F (Cont'd)

SUMMARY OF FEDERAL FUNDS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT:
FISCAL YEARS 1985, 1986, AND 1987

(MILLIONS OF DOLLARS)

ITEM	ACTUAL, 1985	ESTIMATES			
		1986	% CHG 1985-1986	1987	% CHG 1986-1987
DEVELOPMENT	32,202.1	35,607.1	10.6%	42,368.5	19.0%
PERFORMERS:					
FEDERAL INTRAMURAL 1/	7,889.1	8,425.4	6.8	10,066.4	19.5
INDUSTRIAL FIRMS	19,816.5	22,541.8	13.8	27,456.8	21.8
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	1,299.4	1,456.8	12.1	1,324.9	-9.1
UNIVERSITIES AND COLLEGES	625.8	645.8	3.2	716.6	11.0
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	1,198.6	1,193.5	-.4	1,358.2	13.8
OTHER NONPROFIT INSTITUTIONS	654.6	562.2	-14.1	550.0	-2.2
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	591.9	636.7	7.6	786.0	23.5
STATE AND LOCAL GOVERNMENTS	17.5	18.3	4.5	13.1	-28.2
FOREIGN	108.8	126.7	16.4	96.5	-23.8
R&D PLANT	1,821.2	1,717.4	-5.7	1,709.5	-.5
PERFORMERS SUPPORTED:					
FEDERAL INTRAMURAL	630.6	587.6	-6.8	477.0	-18.8
INDUSTRIAL FIRMS	298.5	277.8	-6.9	472.7	70.2
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	187.8	214.1	14.0	227.9	6.5
UNIVERSITIES AND COLLEGES	136.2	168.1	23.4	81.1	-51.8
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	454.2	435.7	-4.1	409.0	-6.1
OTHER NONPROFIT INSTITUTIONS	69.4	8.5	-87.8	34.8	309.7
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	9.1	5.8	-36.6	4.6	-20.5
STATE AND LOCAL GOVERNMENTS	.1	.0	-100.0	.0	N/A
FOREIGN	35.5	19.8	-44.1	2.4	-87.9

1/ COSTS ASSOCIATED WITH THE ADMINISTRATION OF INTRAMURAL AND EXTRAMURAL PROGRAMS ARE COVERED AS WELL AS ACTUAL INTRAMURAL PERFORMANCE.

* INDICATES PERCENTAGE LESS THAN .05%.

SOURCE: NATIONAL SCIENCE FOUNDATION

Table 6.3.F

FEDERAL FUNDS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT, BY AGENCY: FISCAL YEARS 1985, 1986, AND 1987

(MILLIONS OF DOLLARS)

AGENCY AND SUBDIVISION	OBLIGATIONS			OUTLAYS		
	1985	ESTIMATES		1985	ESTIMATES	
		1986	1987		1986	1987
TOTAL, ALL AGENCIES	50,153.5	53,779.1	60,919.2	45,835.8	49,825.1	52,530.0
DEPARTMENTS						
DEPARTMENT OF AGRICULTURE, TOTAL	983.6	1,015.0	950.9	923.2	961.3	981.1
AGRICULTURAL COOPERATIVE SERVICE	2.9	2.8	1.9	2.9	2.8	1.9
AGRICULTURAL MARKETING SERVICE	1.7	1.6	-	1.3	1.6	-
AGRICULTURAL RESEARCH SERVICE	498.7	545.2	528.4	492.9	494.6	549.8
COOPERATIVE STATE RESEARCH SERVICE	294.3	272.6	244.4	243.6	268.3	245.2
ECONOMIC RESEARCH SERVICE	46.4	44.9	45.5	45.1	45.0	45.4
FEDERAL GRAIN INSPECTION SERVICE	.9	1.1	1.1	.9	1.0	1.2
FOREST SERVICE	114.8	120.5	111.8	113.8	119.9	115.1
HUMAN NUTRITION INFORMATION SERVICE	6.7	12.9	6.9	7.2	10.9	6.9
OFFICE OF INTERNATIONAL COOPERATION AND DEVELOPMENT	7.7	4.4	1.9	5.8	8.1	6.7
OFFICE OF TRANSPORTATION	1.2	1.0	.5	1.3	1.0	.5
STATISTICAL REPORTING SERVICE	8.4	8.1	8.4	8.4	8.1	8.4
DEPARTMENT OF COMMERCE, TOTAL	403.0	397.9	312.6	377.8	369.8	322.6
BUREAU OF THE CENSUS	4.9	5.1	5.1	4.8	4.9	4.9
ECONOMIC DEVELOPMENT ADMINISTRATION	13.0	10.0	-	7.8	-	3.0
NATIONAL BUREAU OF STANDARDS	104.7	103.1	103.0	106.5	100.1	102.8
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION	269.8	271.1	196.3	249.1	255.8	203.0
NATIONAL TELECOMMUNICATIONS & INFORMATION ADMIN	9.1	8.2	8.2	9.0	8.3	8.2
OFFICE OF THE SECRETARY	1.4	.4	-	.6	.6	.6
DEPARTMENT OF DEFENSE, TOTAL	30,322.4	34,074.3	41,087.4	27,143.7	29,742.0	32,608.7
DEPARTMENT OF THE ARMY	4,623.7	4,905.6	5,763.8	4,230.0	4,504.7	4,738.6
MILITARY FUNCTIONS	4,590.6	4,872.2	5,728.4	4,197.0	4,471.2	4,703.2
MILITARY CONSTRUCTION	32.7	35.9	40.3	38.0	27.4	73.0
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	211.9	223.9	222.6	209.0	225.5	221.4
RDT&E APPROPRIATION	4,345.6	4,611.6	5,465.5	3,949.9	4,217.9	4,408.8
SPECIAL FOREIGN CURRENCY PROGRAM	.5	.8	-	.1	.4	-
CIVIL FUNCTIONS (CORPS OF ENGINEERS)	33.0	33.4	35.4	33.0	33.4	35.4
DEPARTMENT OF THE NAVY	9,309.5	10,278.4	10,846.7	8,304.9	9,052.1	9,050.5
MILITARY CONSTRUCTION	82.9	47.7	60.4	46.7	41.4	59.0
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	204.0	223.1	225.1	203.2	222.3	224.6
RDT&E APPROPRIATION	9,016.9	10,004.4	10,559.0	8,053.6	8,786.9	8,765.3
SPECIAL FOREIGN CURRENCY PROGRAM	5.8	3.1	2.2	1.4	1.6	1.7
DEPARTMENT OF THE AIR FORCE	13,552.2	13,967.1	17,524.2	12,263.7	12,348.4	13,606.2
MILITARY CONSTRUCTION	56.7	49.3	58.5	42.6	33.8	43.3
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	648.4	682.2	679.9	648.4	682.2	679.9
RDT&E APPROPRIATION	12,847.1	13,235.6	16,785.7	11,572.7	11,632.5	12,882.9
DEFENSE AGENCIES	2,786.3	4,812.7	6,816.7	2,290.0	3,767.5	5,113.7
RDT&E APPROPRIATION	2,784.6	4,808.8	6,778.1	2,286.9	3,763.8	5,105.1
SPECIAL FOREIGN CURRENCY PROGRAM	.7	.5	.5	.2	.3	.4
TEST & EVALUATION, DEPUTY UNDERSECRETARY DEFENSE	50.6	110.5	136.0	55.1	69.3	99.8
DEPARTMENT OF EDUCATION	126.0	169.3	116.5	95.7	143.1	141.1
DEPARTMENT OF ENERGY	5,834.4	5,437.4	5,528.5	5,803.0	5,672.0	5,641.5
DEPARTMENT OF HEALTH AND HUMAN SERVICES, TOTAL	5,493.6	5,665.0	5,280.2	5,049.6	5,670.7	5,384.3
ALCOHOL, DRUG ABUSE & MENTAL HEALTH ADMINISTRATION	377.9	397.5	383.7	349.8	369.5	375.0
CENTERS FOR DISEASE CONTROL	47.6	48.8	49.2	47.6	48.8	49.2
FOOD & DRUG ADMINISTRATION	95.1	87.4	82.8	96.2	89.2	86.2
HEALTH CARE FINANCING ADMINISTRATION	33.5	22.9	18.5	33.5	22.9	18.5
HEALTH RESOURCES AND SERVICES ADMIN	19.7	20.8	8.4	16.0	17.9	17.3
HUMAN DEVELOPMENT SERVICES	24.3	29.0	18.6	21.4	29.5	29.6
NATIONAL INSTITUTES OF HEALTH 1/	4,856.9	5,021.7	4,680.3	4,446.3	5,052.6	4,770.9
OFFICE OF ASSISTANT SECRETARY FOR HEALTH	18.6	17.9	20.4	15.8	21.3	20.4
OFFICE OF THE SECRETARY	9.6	6.5	5.0	9.6	6.5	5.0
SOCIAL SECURITY ADMINISTRATION	10.4	12.5	13.3	13.3	12.5	12.2
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT	18.5	16.0	19.7	18.6	17.1	17.3

Table 6.3.F FEDERAL [illegible] R RESEARCH, DEVELOPMENT, AND R&D PLANT, BY AGENCY: FISCAL YEARS 1985, 1986, AND 1987

(MILLIONS OF DOLLARS)

- CONTINUED

AGENCY AND SUBDIVISION	OBLIGATIONS			OUTLAYS		
	1985	ESTIMATES		1985	ESTIMATES	
		1986	1987		1986	1987
DEPARTMENT OF THE INTERIOR, TOTAL	395.9	394.6	351.4	417.0	412.0	358.5
BUREAU OF LAND MANAGEMENT	4.4	3.4	3.0	4.4	3.4	3.0
BUREAU OF MINES	89.9	88.7	61.2	100.4	100.8	68.3
BUREAU OF RECLAMATION	13.2	10.5	9.7	10.5	11.5	9.7
GEOLOGICAL SURVEY [2]	215.7	219.5	208.2	230.8	224.3	206.5
MINERAL MANAGEMENT SERVICE	1.4	1.3	1.1	1.5	1.4	1.2
NATIONAL PARK SERVICE	15.0	15.5	16.0	15.0	15.5	16.0
OFFICE OF THE SECRETARY	1.9	2.1	-	.3	2.0	2.0
OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT	2.0	2.5	3.1	2.0	2.5	3.1
UNITED STATES FISH AND WILDLIFE SERVICE	52.4	51.0	49.1	52.1	50.6	48.9
DEPARTMENT OF JUSTICE, TOTAL	34.0	37.4	36.1	32.7	44.8	38.0
DRUG ENFORCEMENT ADMINISTRATION	1.6	3.2	2.5	1.6	3.1	2.5
FEDERAL BUREAU OF INVESTIGATION	9.5	13.2	15.0	8.9	12.4	14.1
FEDERAL PRISON SYSTEM	1.5	1.4	1.5	1.5	1.4	1.5
IMMIGRATION AND NATURALIZATION SERVICE	.4	.4	.4	.4	.4	.4
OFFICE OF JUSTICE PROGRAMS	22.7	18.9	16.7	20.1	27.0	19.6
OFFICE OF LEGAL POLICY	.3	.3	-	.2	.5	-
DEPARTMENT OF LABOR, TOTAL	13.3	11.5	26.4	13.7	11.3	14.1
BUREAU OF LABOR STATISTICS	.6	.6	.6	.6	.6	.6
EMPLOYMENT STANDARDS ADMINISTRATION	*	*	.2	*	*	.2
EMPLOYMENT AND TRAINING ADMINISTRATION	3.5	3.7	16.7	4.5	3.0	4.5
LABOR-MANAGEMENT RELATIONS & COOPERATIVE PROGRAMS [3]	.3	.2	.2	.3	.2	.2
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION	4.5	3.6	4.5	4.5	3.6	4.5
OFFICE OF PENSION & WELFARE BENEFITS	1.6	.6	1.4	1.1	1.1	1.4
OFFICE OF THE SECRETARY	2.6	2.6	2.6	2.6	2.6	2.6
PENSION BENEFIT GUARANTEE CORPORATION	.2	.1	.2	.2	.1	.2
DEPARTMENT OF STATE, TOTAL	1.5	1.4	2.6	1.5	1.4	2.6
DEPARTMENTAL FUNDS	1.5	1.4	2.6	1.5	1.4	2.6
DEPARTMENT OF TRANSPORTATION, TOTAL	410.6	353.4	262.9	405.6	392.6	298.2
COAST GUARD	19.0	20.1	20.5	19.0	20.1	20.5
FEDERAL AVIATION ADMINISTRATION	294.8	234.3	160.0	283.7	274.4	192.4
FEDERAL HIGHWAY ADMINISTRATION	21.7	22.4	23.9	23.0	19.6	24.1
FEDERAL RAILROAD ADMINISTRATION	15.0	21.0	9.6	16.2	20.1	11.8
MARITIME ADMINISTRATION	13.9	10.8	6.6	10.2	11.9	11.3
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION	28.6	26.3	27.3	28.0	26.7	27.2
OFFICE OF THE SECRETARY	4.8	4.8	5.0	4.7	7.3	2.5
RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION	2.7	2.4	2.4	2.4	2.1	2.1
URBAN MASS TRANSPORTATION ADMINISTRATION	10.2	11.5	7.7	18.6	10.5	6.4
DEPARTMENT OF THE TREASURY, TOTAL	24.4	24.8	25.1	24.3	24.4	24.7
BUREAU OF ENGRAVING AND PRINTING	5.0	5.3	5.4	5.0	5.3	5.4
INTERNAL REVENUE SERVICE	15.9	14.4	14.6	15.9	14.1	14.2
OFFICE OF PROTECTIVE RESEARCH	.6	.2	.3	.6	.2	.3
UNITED STATES CUSTOMS SERVICE	2.3	3.8	3.5	2.3	3.8	3.5
UNITED STATES MINT	.6	1.1	1.3	.6	1.0	1.3
OTHER AGENCIES						
ADVISORY COMMISSION ON INTERGOVERNMENTAL RELATIONS	2.4	2.1	2.1	2.0	2.0	2.1
AGENCY FOR INTERNATIONAL DEVELOPMENT	227.2	226.6	244.1	233.0	330.2	281.8
APPALACHIAN REGIONAL COMMISSION	.2	.2	.2	.2	.2	.2
CONSUMER PRODUCT SAFETY COMMISSION	2.4	2.0	.3	2.2	2.1	.6
ENVIRONMENTAL PROTECTION AGENCY	320.4	333.6	309.6	274.8	317.7	331.8
FEDERAL COMMUNICATIONS COMMISSION	1.2	1.1	.7	1.1	1.1	.7
FEDERAL EMERGENCY MANAGEMENT AGENCY	4.1	-	-	4.6	2.5	.5
FEDERAL HOME LOAN BANK BOARD	2.8	3.1	3.4	2.8	3.1	3.4
FEDERAL TRADE COMMISSION	1.7	1.8	1.9	1.7	1.8	1.9
GENERAL SERVICES ADMINISTRATION [4]	.4	.9	1.7	.4	.9	1.7
INTERNATIONAL TRADE COMMISSION	5.8	6.8	7.2	5.8	6.8	7.2
LIBRARY OF CONGRESS	7.1	6.8	7.5	6.3	7.4	7.8
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	3,561.5	3,721.8	4,272.2	3,217.1	3,798.9	4,052.9
NATIONAL ARCHIVES	.5	1.4	1.1	.5	1.4	1.1
NATIONAL SCIENCE FOUNDATION	1,419.1	1,401.5	1,592.3	1,250.0	1,406.0	1,536.0
NUCLEAR REGULATORY COMMISSION	150.0	134.7	113.5	161.1	142.9	122.8
SMITHSONIAN INSTITUTION	72.7	63.6	72.7	59.8	71.5	76.4
TENNESSEE VALLEY AUTHORITY	80.0	77.0	69.0	81.0	78.2	69.0
UNITED STATES ARMS CONTROL AND DISARMAMENT AGENCY	1.1	1.4	1.7	1.1	1.4	1.7
UNITED STATES INFORMATION AGENCY	.1	-	-	1.1	.2	.2
VETERANS ADMINISTRATION	229.9	194.6	218.0	222.7	186.4	197.5

1/ DETAILED NIH DATA FOR FY 1985, 1986, AND 1987 WERE UNAVAILABLE AT THE TIME OF PUBLICATION. FIELD OF SCIENCE/ENGINEERING, PERFORMER, AND GEOGRAPHIC DATA WERE ESTIMATED BY NSF.

2/ THE OFFICE OF WATER RESEARCH AND TECHNOLOGY HAS BEEN COMBINED WITH THE GEOLOGICAL SURVEY.

3/ IN 1984 THE LABOR-MANAGEMENT SERVICES ADMINISTRATION WAS REPLACED BY LABOR-MANAGEMENT RELATIONS & COOPERATIVE PROGRAMS.

4/ THE NATIONAL ARCHIVES IS NO LONGER INCLUDED AS A COMPONENT OF THE GENERAL SERVICES ADMINISTRATION.

* INDICATES AMOUNT LESS THAN $50,000.

SOURCE: NATIONAL SCIENCE FOUNDATION

Table 6.4.F FEDERAL FUNDS FOR TOTAL RESEARCH AND DEVELOPMENT, BY AGENCY: FISCAL YEARS 1985, 1986, AND 1987

(MILLIONS OF DOLLARS)

AGENCY AND SUBDIVISION	OBLIGATIONS			OUTLAYS		
	1985	ESTIMATES		1985	ESTIMATES	
		1986	1987		1986	1987
TOTAL, ALL AGENCIES	48,332.3	52,061.8	59,209.6	44,146.9	48,107.9	50,781.9
DEPARTMENTS						
DEPARTMENT OF AGRICULTURE, TOTAL	943.0	923.0	909.2	889.0	913.5	912.3
AGRICULTURAL COOPERATIVE SERVICE	2.9	2.8	1.9	2.9	2.8	1.9
AGRICULTURAL MARKETING SERVICE	1.7	1.6	-	1.3	1.6	-
AGRICULTURAL RESEARCH SERVICE	469.7	463.1	497.0	466.2	458.4	492.3
COOPERATIVE STATE RESEARCH SERVICE	284.3	263.1	234.4	236.7	257.9	234.6
ECONOMIC RESEARCH SERVICE	46.4	44.9	45.5	45.1	45.0	45.4
FEDERAL GRAIN INSPECTION SERVICE	.9	1.1	1.1	.9	1.0	1.2
FOREST SERVICE	113.1	120.1	111.5	113.1	118.8	114.5
HUMAN NUTRITION INFORMATION SERVICE	6.7	12.9	6.9	7.2	10.9	6.9
OFFICE OF INTERNATIONAL COOPERATION AND DEVELOPMENT	7.7	4.6	1.9	5.8	8.1	6.7
OFFICE OF TRANSPORTATION	1.2	1.0	.5	1.3	1.0	.5
STATISTICAL REPORTING SERVICE	8.4	8.1	8.4	8.4	8.1	8.4
DEPARTMENT OF COMMERCE, TOTAL	398.8	391.1	300.9	373.6	363.2	310.9
BUREAU OF THE CENSUS	4.9	5.1	5.1	4.8	4.9	4.9
ECONOMIC DEVELOPMENT ADMINISTRATION	13.0	10.0	-	7.8	-	3.0
NATIONAL BUREAU OF STANDARDS	100.5	99.3	91.4	102.2	96.5	91.1
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION	269.8	268.1	196.3	249.1	252.8	203.0
NATIONAL TELECOMMUNICATIONS & INFORMATION ADMIN	9.1	8.2	8.2	9.0	8.3	8.2
OFFICE OF THE SECRETARY	1.4	.4	-	.6	.6	.6
DEPARTMENT OF DEFENSE, TOTAL	29,791.5	33,644.3	40,678.8	26,742.0	29,407.1	32,238.4
DEPARTMENT OF THE ARMY	4,570.8	4,850.2	5,710.2	4,176.6	4,458.8	4,650.1
MILITARY FUNCTIONS	4,537.7	4,816.8	5,674.8	4,143.6	4,425.3	4,614.7
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	211.9	223.9	222.6	209.0	225.5	221.4
RDT&E APPROPRIATION	4,325.4	4,592.1	5,452.2	3,934.5	4,199.4	4,393.3
SPECIAL FOREIGN CURRENCY PROGRAM	.5	.8	-	.1	.4	-
CIVIL FUNCTIONS (CORPS OF ENGINEERS)	33.0	33.4	35.4	33.0	33.4	35.4
DEPARTMENT OF THE NAVY	9,127.4	10,137.3	10,700.8	8,161.1	8,924.9	8,915.8
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	204.0	223.1	225.1	203.2	222.3	224.6
RDT&E APPROPRIATION	8,917.7	9,911.1	10,473.5	7,956.5	8,701.1	8,689.5
SPECIAL FOREIGN CURRENCY PROGRAM	5.8	3.1	2.2	1.4	1.6	1.7
DEPARTMENT OF THE AIR FORCE	13,260.9	13,757.5	17,356.5	12,063.9	12,199.3	13,469.0
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	648.4	682.2	679.9	648.4	682.2	679.9
RDT&E APPROPRIATION	12,612.5	13,075.3	16,676.6	11,415.5	11,517.1	12,789.0
DEFENSE AGENCIES	2,781.7	4,790.7	6,775.3	2,285.2	3,754.8	5,103.8
RDT&E APPROPRIATION	2,781.0	4,790.2	6,774.8	2,285.1	3,754.6	5,103.4
SPECIAL FOREIGN CURRENCY PROGRAM	.7	.5	.5	.2	.3	.4
TEST & EVALUATION, DEPUTY UNDERSECRETARY DEFENSE	50.6	110.5	136.0	55.1	69.3	99.8
DEPARTMENT OF EDUCATION	124.9	130.6	116.5	95.7	132.6	122.3
DEPARTMENT OF ENERGY	4,966.0	4,691.6	4,770.7	4,947.7	4,776.9	4,814.7
DEPARTMENT OF HEALTH AND HUMAN SERVICES, TOTAL	5,451.0	5,611.3	5,270.8	5,007.0	5,625.4	5,358.0
ALCOHOL, DRUG ABUSE & MENTAL HEALTH ADMINISTRATION	377.6	396.2	383.1	348.4	369.1	374.0
CENTERS FOR DISEASE CONTROL	47.6	48.8	49.2	47.6	48.8	49.2
FOOD & DRUG ADMINISTRATION	82.1	79.4	82.0	81.2	79.2	80.2
HEALTH CARE FINANCING ADMINISTRATION	33.5	22.9	18.5	33.5	22.9	18.5
HEALTH RESOURCES AND SERVICES ADMIN	19.7	20.8	8.4	16.0	17.9	17.3
HUMAN DEVELOPMENT SERVICES	24.3	29.0	18.6	21.4	29.5	29.6
NATIONAL INSTITUTES OF HEALTH 1/	4,827.7	4,977.3	4,672.3	4,420.1	5,017.7	4,751.7
OFFICE OF ASSISTANT SECRETARY FOR HEALTH	18.6	17.9	20.4	15.8	21.3	20.4
OFFICE OF THE SECRETARY	9.6	6.5	5.0	9.6	6.5	5.0
SOCIAL SECURITY ADMINISTRATION	10.4	12.5	13.3	13.3	12.5	12.2
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT	18.5	16.0	19.7	18.6	17.1	17.3

Table 6.5.F FEDERAL OBLIGATIONS FOR TOTAL RESEARCH AND DEVELOPMENT, BY AGENCY AND CHARACTER OF WORK: FISCAL YEAR 1986 (ESTIMATED)

(THOUSANDS OF DOLLARS)

AGENCY AND SUBDIVISION	TOTAL	RESEARCH		DEVELOPMENT
		BASIC	APPLIED	
TOTAL, ALL AGENCIES	52,061,753	8,145,128	8,309,546	35,607,079
DEPARTMENTS				
DEPARTMENT OF AGRICULTURE, TOTAL	923,045	432,746	458,809	31,490
AGRICULTURAL COOPERATIVE SERVICE	2,798	-	2,798	-
AGRICULTURAL MARKETING SERVICE	1,569	-	1,270	299
AGRICULTURAL RESEARCH SERVICE	463,100	247,600	188,100	27,400
COOPERATIVE STATE RESEARCH SERVICE	263,084	126,174	136,910	-
ECONOMIC RESEARCH SERVICE	44,891	4,489	40,402	-
FEDERAL GRAIN INSPECTION SERVICE	1,110	-	580	530
FOREST SERVICE	120,127	50,462	66,745	2,920
HUMAN NUTRITION INFORMATION SERVICE	12,900	-	12,900	-
OFFICE OF INTERNATIONAL COOPERATION AND DEVELOPMENT	4,426	885	3,319	222
OFFICE OF TRANSPORTATION	951	475	357	119
STATISTICAL REPORTING SERVICE	8,089	2,661	5,428	-
DEPARTMENT OF COMMERCE, TOTAL	391,073	22,079	304,413	64,581
BUREAU OF THE CENSUS	5,059	405	2,170	2,484
ECONOMIC DEVELOPMENT ADMINISTRATION	10,000	-	-	10,000
NATIONAL BUREAU OF STANDARDS	99,317	21,247	65,583	12,487
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION	268,059	-	229,660	38,399
NATIONAL TELECOMMUNICATIONS & INFORMATION ADMIN	8,211	-	7,000	1,211
OFFICE OF THE SECRETARY	427	427	-	-
DEPARTMENT OF DEFENSE, TOTAL	33,646,318	994,323	2,364,779	30,287,216
DEPARTMENT OF THE ARMY	4,850,243	242,415	551,258	4,056,570
DEPARTMENT OF THE NAVY	10,137,285	350,478	463,887	9,322,920
DEPARTMENT OF THE AIR FORCE	13,757,502	234,388	573,442	12,949,672
DEFENSE AGENCIES	4,790,745	167,042	776,192	3,847,511
TEST & EVALUATION, DEPUTY UNDERSECRETARY DEFENSE	110,543	-	-	110,543
DEPARTMENT OF EDUCATION	130,555	9,844	84,931	35,780
DEPARTMENT OF ENERGY	4,691,592	945,940	1,080,358	2,665,294
DEPARTMENT OF HEALTH AND HUMAN SERVICES, TOTAL	5,611,294	3,357,107	1,833,962	420,225
ALCOHOL, DRUG ABUSE & MENTAL HEALTH ADMINISTRATION	396,221	206,169	188,810	1,242
CENTERS FOR DISEASE CONTROL	48,785	-	48,785	-
FOOD & DRUG ADMINISTRATION	79,430	-	79,430	-
HEALTH CARE FINANCING ADMINISTRATION	22,912	-	22,912	-
HEALTH RESOURCES AND SERVICES ADMIN	20,766	900	18,153	1,713
HUMAN DEVELOPMENT SERVICES	28,969	-	4,307	24,662
NATIONAL INSTITUTES OF HEALTH 1/	4,977,265	3,133,600	1,452,765	390,900
OFFICE OF ASSISTANT SECRETARY FOR HEALTH	17,946	16,438	-	1,508
OFFICE OF THE SECRETARY	6,500	-	6,300	200
SOCIAL SECURITY ADMINISTRATION	12,500	-	12,500	-
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT	15,979	-	5,903	10,076
DEPARTMENT OF THE INTERIOR, TOTAL	388,340	137,589	227,534	23,217
BUREAU OF LAND MANAGEMENT	3,400	-	2,100	1,300
BUREAU OF MINES	88,690	46,804	39,390	2,496
BUREAU OF RECLAMATION	10,527	175	8,852	1,500
GEOLOGICAL SURVEY 2/	218,620	83,379	127,820	7,421
MINERAL MANAGEMENT SERVICE	1,338	-	1,338	-
NATIONAL PARK SERVICE	15,500	-	15,500	-
OFFICE OF THE SECRETARY	2,131	2,131	-	-
OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT	2,534	-	2,534	-
UNITED STATES FISH AND WILDLIFE SERVICE	45,600	5,100	30,000	10,500
DEPARTMENT OF JUSTICE, TOTAL	37,428	3,437	12,950	21,041
DRUG ENFORCEMENT ADMINISTRATION	3,200	-	800	2,400
FEDERAL BUREAU OF INVESTIGATION	13,227	-	-	13,227
FEDERAL PRISON SYSTEM	1,432	-	1,050	382
IMMIGRATION AND NATURALIZATION SERVICE	400	-	200	200
OFFICE OF JUSTICE PROGRAMS	18,869	3,437	10,600	4,832
OFFICE OF LEGAL POLICY	300	-	300	-

Table 6.6.F FEDERAL OBLIGATIONS FOR TOTAL RESEARCH AND DEVELOPMENT, BY AGENCY AND CHARACTER OF WORK: FISCAL YEAR 1987 (ESTIMATED)

(THOUSANDS OF DOLLARS)

AGENCY AND SUBDIVISION	TOTAL	RESEARCH		DEVELOPMENT
		BASIC	APPLIED	
TOTAL, ALL AGENCIES	59,209,627	8,347,692	8,493,409	42,368,526
DEPARTMENTS				
DEPARTMENT OF AGRICULTURE, TOTAL	909,173	434,054	443,960	31,159
AGRICULTURAL COOPERATIVE SERVICE	1,941	-	1,941	-
AGRICULTURAL RESEARCH SERVICE	497,000	267,200	202,400	27,400
COOPERATIVE STATE RESEARCH SERVICE	234,428	115,767	118,661	-
ECONOMIC RESEARCH SERVICE	45,475	4,548	40,927	-
FEDERAL GRAIN INSPECTION SERVICE	1,100	-	500	600
FOREST SERVICE	111,481	43,127	65,354	3,000
HUMAN NUTRITION INFORMATION SERVICE	6,876	-	6,876	-
OFFICE OF INTERNATIONAL COOPERATION AND DEVELOPMENT	1,934	386	1,451	97
OFFICE OF TRANSPORTATION	500	250	188	62
STATISTICAL REPORTING SERVICE	8,438	2,776	5,662	-
DEPARTMENT OF COMMERCE, TOTAL	300,935	19,472	236,741	44,722
BUREAU OF THE CENSUS	5,074	407	2,181	2,486
NATIONAL BUREAU OF STANDARDS	91,374	19,065	63,475	8,834
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION	196,255	-	163,787	32,468
NATIONAL TELECOMMUNICATIONS & INFORMATION ADMIN	8,232	-	7,298	934
DEPARTMENT OF DEFENSE, TOTAL	40,678,754	995,881	2,636,101	37,046,772
DEPARTMENT OF THE ARMY	5,710,219	249,268	719,387	4,741,564
DEPARTMENT OF THE NAVY	10,700,807	385,577	464,649	9,850,581
DEPARTMENT OF THE AIR FORCE	17,356,488	284,531	562,156	16,509,801
DEFENSE AGENCIES	6,775,265	76,505	889,909	5,808,851
TEST & EVALUATION, DEPUTY UNDERSECRETARY DEFENSE	135,975	-	-	135,975
DEPARTMENT OF EDUCATION	116,479	5,625	88,546	22,308
DEPARTMENT OF ENERGY	4,770,736	1,063,065	913,254	2,794,417
DEPARTMENT OF HEALTH AND HUMAN SERVICES, TOTAL	5,270,766	3,162,409	1,724,010	384,347
ALCOHOL, DRUG ABUSE & MENTAL HEALTH ADMINISTRATION	383,111	204,378	177,514	1,219
CENTERS FOR DISEASE CONTROL	49,194	-	49,194	-
FOOD & DRUG ADMINISTRATION	82,015	-	82,015	-
HEALTH CARE FINANCING ADMINISTRATION	18,500	-	18,500	-
HEALTH RESOURCES AND SERVICES ADMIN	8,354	900	7,454	-
HUMAN DEVELOPMENT SERVICES	18,617	-	3,039	15,578
NATIONAL INSTITUTES OF HEALTH 1/	4,672,294	2,938,300	1,368,194	365,800
OFFICE OF ASSISTANT SECRETARY FOR HEALTH	20,381	18,831	-	1,550
OFFICE OF THE SECRETARY	5,000	-	4,800	200
SOCIAL SECURITY ADMINISTRATION	13,300	-	13,300	-
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT	19,665	-	7,346	12,319
DEPARTMENT OF THE INTERIOR, TOTAL	350,631	115,742	210,905	23,984
BUREAU OF LAND MANAGEMENT	3,000	-	1,900	1,100
BUREAU OF MINES	61,182	30,552	29,846	784
BUREAU OF RECLAMATION	9,670	140	8,130	1,400
GEOLOGICAL SURVEY 2/	207,565	79,450	118,215	9,900
MINERAL MANAGEMENT SERVICE	1,114	-	1,114	-
NATIONAL PARK SERVICE	16,000	-	16,000	-
OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT	3,100	-	3,100	-
UNITED STATES FISH AND WILDLIFE SERVICE	49,000	5,600	32,600	10,800
DEPARTMENT OF JUSTICE, TOTAL	36,127	2,505	12,120	21,502
DRUG ENFORCEMENT ADMINISTRATION	2,500	-	800	1,700
FEDERAL BUREAU OF INVESTIGATION	15,027	-	-	15,027
FEDERAL PRISON SYSTEM	1,500	-	1,100	400
IMMIGRATION AND NATURALIZATION SERVICE	400	-	200	200
OFFICE OF JUSTICE PROGRAMS	16,700	2,505	10,020	4,175

Table 6.7.F FEDERAL OBLIGATIONS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT TO FEDERALLY FUNDED RESEARCH AND DEVELOPMENT CENTERS (FFRDCS), BY CATEGORY OF FFRDC, INDIVIDUAL FFRDC AND AGENCY:FISCAL YEAR 1985

(THOUSANDS OF DOLLARS)

FEDERALLY FUNDED RESEARCH AND DEVELOPMENT CENTERS	TOTAL	DEPT OF COMMERCE	DEPT OF DEFENSE	DEPT OF ENERGY	DEPT OF HEALTH & HUMAN SERVICES	NATIONAL AERO-NAUTICS & SPACE ADMIN	NATIONAL SCIENCE FOUNDA-TION	OTHER
TOTAL, ALL FFRDC'S	5,659,772	1,982	985,566	4,122,110	62,132	257,284	101,702	128,996
RESEARCH LABORATORIES	489,330	350	3,817	349,813	34,954	200	99,416	780
FERMILAB	196,780	-	321	196,254	-	200	5	-
STANFORD LINEAR ACCELERATOR CTR	157,630	-	3,496	153,559	575	-	-	-
FREDERICK CANCER RSCH CENTER	34,379	-	-	-	34,379	-	-	-
NAT'L ASTRONOMY & IONOSPHERE CTR	6,100	-	-	-	-	-	6,100	-
NAT'L CENTER FOR ATMOSPHERIC RSCH	44,911	350	-	-	-	-	43,781	780
NAT'L OPTICAL ASTRONOMY OBSERVATORY	22,880	-	-	-	-	-	22,880	-
NAT'L RADIO ASTRONOMY OBSERVATORY	26,650	-	-	-	-	-	26,650	-
R & D LABORATORIES	4,613,511	1,632	427,571	3,770,313	27,178	256,375	2,286	128,156
LINCOLN LABORATORY	195,184	-	188,159	-	-	271	160	6,594
AMES LABORATORY	17,895	-	233	17,662	-	-	-	-
ARGONNE NATIONAL LABORATORY	201,210	83	641	194,631	695	-	12	5,148
BETTIS ATOMIC POWER LAB	355,835	-	78,970	276,865	-	-	-	-
BROOKHAVEN NATIONAL LAB	198,924	37	1,768	183,791	4,319	-	450	8,559
E.O. LAWRENCE BERKELEY LAB	165,326	-	7,878	138,940	17,012	-	62	1,434
E.O. LAWRENCE LIVERMORE NAT'L LAB	744,523	-	42,453	699,104	-	-	-	2,966
ENERGY TECH ENGINEERING CTR	21,796	-	-	21,283	-	-	-	513
HANFORD ENGINEERING DEV LAB	102,577	-	-	102,035	-	-	-	542
IDAHO NAT'L ENGINEERING LAB	160,076	-	90	125,106	-	-	-	34,880
KNOLLS ATOMIC POWER LAB	189,375	-	14,672	174,703	-	-	-	-
LOS ALAMOS NATIONAL LAB	592,405	-	52,055	531,700	104	-	80	8,466
OAK RIDGE ASSOCIATED UNIVERSITIES	14,875	10	1,795	11,207	648	-	-	1,215
OAK RIDGE NATIONAL LAB	355,653	-	3,001	332,510	1,173	-	1,497	17,472
PACIFIC NORTHWEST LABORATORY	89,542	1,502	3,101	71,885	2,481	35	-	10,538
PLASMA PHYSICS LABORATORY	117,935	-	225	117,710	-	-	-	-
SANDIA NATIONAL LABORATORIES	688,407	-	28,253	635,267	-	-	-	24,887
SAVANNAH RIVER LABORATORY	69,015	-	-	69,015	-	-	-	-
SOLAR ENERGY RESEARCH INST	53,584	-	-	53,554	-	-	-	30
JET PROPULSION LABORATORY	279,374	-	4,277	13,345	746	256,069	25	4,912
STUDY AND ANALYSIS CENTERS	82,102	-	82,102	-	-	-	-	-
RAND - PROJECT AIR FORCE	18,327	-	18,327	-	-	-	-	-
CENTER FOR NAVAL ANALYSES	25,435	-	25,435	-	-	-	-	-
INST FOR DEFENSE ANALYSES	25,953	-	25,953	-	-	-	-	-
LOGISTICS MANAGEMENT INSTITUTE	11,752	-	11,752	-	-	-	-	-
OSD/OJCS	635	-	635	-	-	-	-	-
SYSTEM ENGINEERING/INTEGRATION CENTERS	474,829	-	472,076	1,984	-	709	-	60
AEROSPACE CORPORATION	248,222	-	245,529	1,984	-	709	-	-
MITRE CORP - C3 I DIVISION	220,534	-	220,474	-	-	-	-	60
SOFTWARE ENGINEERING INSTITUTE	6,073	-	6,073	-	-	-	-	-

SOURCE: NATIONAL SCIENCE FOUNDATION

Table 6.8.F

FEDERAL OBLIGATIONS FOR RESEARCH, BY DETAILED FIELD OF SCIENCE/ENGINEERING:
FISCAL YEARS 1985, 1986, AND 1987

(THOUSANDS OF DOLLARS)

FIELD OF SCIENCE/ENGINEERING	ACTUAL, 1985	ESTIMATES	
		1986	1987
TOTAL, ALL FIELDS	16,130,148	16,454,674	16,841,101
LIFE SCIENCES, TOTAL	6,366,221	6,457,632	6,289,247
BIOLOGICAL (EXCLUDING ENVIRONMENTAL)	2,879,066	2,950,774	2,844,342
ENVIRONMENTAL BIOLOGY	260,394	260,633	263,468
AGRICULTURAL	609,333	607,576	612,325
MEDICAL	2,400,238	2,402,237	2,181,057
LIFE SCIENCES, NEC	217,190	236,412	388,055
PSYCHOLOGY, TOTAL	319,035	326,148	318,411
BIOLOGICAL ASPECTS	91,197	92,920	93,046
SOCIAL ASPECTS	142,866	138,261	138,281
PSYCHOLOGICAL SCIENCES, NEC	84,972	94,967	87,084
PHYSICAL SCIENCES, TOTAL	3,044,047	3,071,789	3,300,317
ASTRONOMY	414,743	438,118	514,583
CHEMISTRY	644,473	653,364	670,880
PHYSICS	1,819,988	1,829,362	1,965,380
PHYSICAL SCIENCES, NEC	164,843	150,945	149,474
ENVIRONMENTAL SCIENCES, TOTAL	1,403,574	1,458,207	1,483,405
ATMOSPHERIC	485,982	501,092	535,742
GEOLOGICAL	428,883	431,504	434,852
OCEANOGRAPHY	398,508	437,405	416,723
ENVIRONMENTAL SCIENCES, NEC	90,201	88,206	96,088
MATHEMATICS & COMPUTER SCIENCES, TOTAL	577,502	665,010	758,962
MATHEMATICS	187,088	204,808	214,411
COMPUTER SCIENCES	279,485	306,313	339,994
MATHEMATICS & COMPUTER SCIENCES, NEC	110,929	153,889	204,557
ENGINEERING, TOTAL	3,628,520	3,684,410	3,857,772
AERONAUTICAL	737,992	750,525	817,313
ASTRONAUTICAL	424,742	508,456	682,372
CHEMICAL	254,134	243,526	186,028
CIVIL	214,929	199,449	177,201
ELECTRICAL	626,728	638,123	735,798
MECHANICAL	266,795	263,995	266,711
METALLURGY & MATERIALS	439,050	464,093	465,507
ENGINEERING, NEC	664,150	616,243	526,842
SOCIAL SCIENCES, TOTAL	462,411	434,613	460,217
ANTHROPOLOGY	17,951	11,880	12,757
ECONOMICS	159,572	147,418	163,102
POLITICAL SCIENCE	14,640	12,571	12,511
SOCIOLOGY	66,460	67,956	68,023
SOCIAL SCIENCES, NEC	203,788	194,788	203,824
OTHER SCIENCES, NEC	328,838	356,865	372,770

SOURCE: NATIONAL SCIENCE FOUNDATION

Table 6.1.I

Full-time-equivalent number of R&D scientists and engineers by industry and size of company: 1957-58, 1963-64, 1967-68, and 1974-85

[In thousands]

Industry and size of company	SIC code	1957	1958	1963	1964	1967	1968	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
		January																	
Total	....	229.4	234.8	327.3	340.2	367.2	376.7	360.0	363.3	364.4	382.8	404.4	423.9	450.6	487.8	509.8	522.1	544.5	570.3
Distribution by industry																			
Food and kindred products	20	3.8	4.8	5.1	5.7	6.1	6.3	6.4	6.8	6.9	6.9	6.9	7.4	7.2	7.4	7.4	7.8	7.6	(1)
Textiles and apparel	22,23	.7	.8	1.0	1.2	1.9	2.5	1.8	1.8	1.8	1.7	1.8	1.8	(1)	2.0	1.9	2.0	2.0	2.0
Lumber, wood products, and furniture	24,25	.8	.8	.5	.5	.5	.5	2.1	2.3	2.1	2.1	2.0	1.8	1.7	1.6	(1)	1.8	(1)	(1)
Paper and allied products	26	1.5	1.7	2.5	3.8	4.7	4.8	4.9	5.0	5.2	6.3	6.5	7.1	7.4	8.0	8.4	8.3	7.9	8.2
Chemicals and allied products	28	29.4	31.0	38.3	35.8	36.9	38.9	41.8	45.2	44.4	46.4	48.3	50.0	51.4	54.7	61.6	66.0	67.1	66.9
Industrial chemicals	281-82,286	18.0	18.8	22.9	22.2	21.7	22.3	19.1	21.1	20.1	20.6	21.3	21.4	20.9	21.6	25.9	27.2	26.7	25.1
Drugs and medicines	283	4.7	5.1	6.9	6.9	8.7	9.8	14.0	15.6	16.6	17.8	19.5	20.8	21.6	23.3	25.6	28.2	(1)	(1)
Other chemicals	284-85,287-89	6.7	7.1	8.5	6.7	6.5	6.8	8.7	8.5	7.8	8.0	7.5	7.8	8.9	9.8	10.1	10.6	10.3	10.9
Petroleum refining and related industries	29	6.9	7.6	8.9	8.1	8.7	9.2	8.2	8.4	8.6	8.9	9.9	10.1	10.8	13.0	15.6	14.7	13.2	13.4
Rubber products	30	4.7	4.7	5.8	6.0	5.8	6.1	7.7	8.4	8.6	9.1	7.9	8.1	(1)	10.3	8.1	(1)	(1)	(1)
Stone, clay, and glass products	32	(2)	(2)	3.8	3.3	3.3	4.1	4.5	4.5	4.6	4.5	5.1	5.2	5.4	5.6	5.1	5.0	4.6	5.2
Primary metals	33	5.1	5.2	5.2	5.1	5.9	5.9	6.4	6.3	8.1	8.4	8.1	7.9	8.1	7.9	8.4	8.4	8.5	7.5
Ferrous metals and products[3]	331-32,3398-99	2.9	3.0	2.9	2.8	3.3	3.1	3.3	3.3	3.9	3.9	4.2	4.3	4.7	4.8	5.2	5.3	5.2	4.4
Nonferrous metals and products[3]	333-36	2.2	2.2	2.3	2.3	2.5	2.7	3.1	3.0	4.2	4.5	3.9	3.6	3.4	3.1	3.2	3.1	3.3	3.1
Fabricated metal products	34	8.4	8.3	6.8	7.0	6.3	5.6	7.3	7.4	6.8	7.1	7.0	6.8	7.8	7.8	8.2	(1)	12.9	(1)
Machinery	35	24.9	27.4	31.4	27.3	33.6	37.4	51.0	52.8	55.7	55.3	57.8	60.2	62.1	69.2	76.0	76.3	75.0	77.5
Office, computing, and accounting machines	357	(4)	(4)	(4)	(4)	(4)	(4)	34.5	36.1	38.1	37.7	38.9	40.9	41.8	43.7	48.1	49.6	50.3	52.3
Other machinery, except electrical	351-56,358-59	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	18.9	19.3	20.3	25.5	27.9	26.7	24.7	25.2
Electrical equipment	36	42.9	47.9	85.8	89.5	98.6	98.4	82.6	82.6	80.3	84.1	84.4	85.0	94.5	106.9	109.8	110.3	116.1	121.5
Radio and TV receiving equipment	365	(6)	(6)	(6)	(6)	.9	1.0	1.3	1.0	1.1	.9	1.5	2.1	4.0	7.9	7.8	(1)	(1)	(1)
Communication equipment	366	19.2	22.3	55.1	60.4	66.7	67.4	42.0	40.2	37.4	38.0	39.0	40.4	42.4	44.2	45.9	47.3	56.1	56.8
Electronic components	367							9.6	10.6	10.2	13.0	16.2	14.0	18.1	22.8	24.4	24.5	(1)	26.5
Other electrical equipment	361-64,369	23.7	25.6	30.7	29.1	31.0	30.0	29.7	30.8	31.6	32.2	29.7	28.5	30.0	32.0	31.7	(1)	27.9	(1)
Motor vehicles and motor vehicles equipment	371	13.6	15.0	21.1	23.3	25.2	24.3	27.4	26.0	25.4	28.2	31.9	35.2	38.2	35.1	30.0	29.0	28.6	29.1
Other transportation equipment	373-75,379							1.8	1.9	1.7	1.9	1.9	2.0	1.5	1.4	1.2	1.9	(1)	(1)
Aircraft and missiles	372,376	58.7	58.6	90.7	101.1	100.4	101.1	70.6	67.5	66.9	72.0	82.0	86.5	85.9	95.2	91.1	95.5	96.5	108.4
Professional and scientific instruments	38	10.2	11.0	9.4	10.8	13.0	14.1	17.5	17.9	18.8	20.5	23.3	27.0	32.8	34.7	42.7	(1)	(1)	(1)
Scientific and mechanical measuring instruments	381-82	5.8	6.5	3.9	3.8	3.6	3.8	5.6	5.9	6.7	7.2	9.0	11.7	(1)	18.6	(1)	(1)	(1)	(1)
Optical, surgical, photographic, and other instruments	383-87	4.4	4.5	5.5	7.0	9.4	10	11.9	12.0	12.1	13.3	14.3	15.3	16.3	16.0	16.1	(1)	(1)	(1)
Other manufacturing industries	21,27,31,39	17.8	19.2	2.8	2.0	2.2	2.4	3.7	3.7	4.2	4.5	4.6	4.7	4.6	4.8	5.5	6.1	(1)	(1)
Nonmanufacturing industries	07-17,41-67,737,739,807,891			8.2	9.8	14.1	15.1	14.4	14.9	14.6	15.3	15.0	17.1	19.8	22.2	27.1	26.2	34.9	36.4
Distribution by size of company (based on number of employees)																			
Less than 1,000	....	44.8	48.8	34.1	32.5	27.4	27.2	28.0	30.1	30.2	31.1	29.5	30.5	34.4	38.0	40.7	42.6	53.2	53.2
1,000 to 4,999	....	22.4	24.0	35.0	34.5	30.5	29.9	28.8	29.9	29.3	28.9	27.5	30.9	34.8	38.9	42.8	44.6	44.8	47.7
5,000 to 9,999	....	162.2	171.0	258.2	273.2	24.0	24.6	26.4	27.4	26.1	28.6	28.7	30.7	29.6	27.2	36.6	29.5	29.7	32.8
10,000 to 24,999	....					285.3	295.0	45.9	47.4	50.6	49.3	52.1	55.6	64.4	71.8	77.0	83.6	82.6	85.1
25,000 or more	....							230.9	228.5	228.2	244.9	266.6	276.2	287.4	311.8	312.7	321.7	334.2	351.5

[1] Not separately available but included in total. See general notes.
[2] Data included in the other manufacturing industries group.
[3] SIC codes 3398 and 3399 included in the nonferrous metals and products group for January 1957-64.
[4] Data not tabulated at this level prior to the 1972 survey.
[5] Data not tabulated at this level prior to the 1977 survey.
[6] Included in the other electrical equipment group.

SOURCE: National Science Foundation.

Table 6.2.I

Cost per R&D scientist or engineer by industry and size of company: 1957-58, 1963, 1967, 1972, and 1974-84

Industry and size of company	SIC code	1957	1958	1963	1967	1972	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Total	....	$32,700	$32,800	$37,800	$44,100	$55,300	$63,300	$66,500	$72,200	$75,800	$80,400	$87,400	$94,900	$103,900	$112,600	$118,900	$127,600
Distribution by industry																	
Food and kindred products	20	17,200	16,800	25,200	29,500	39,500	45,200	48,900	51,400	60,100	66,000	72,300	84,900	(1)	(1)	(1)	(1)
Textiles and apparel	22,23	20,000	28,900	26,400	25,900	32,100	38,300	38,900	46,900	47,400	49,400	53,200	57,500	(1)	(1)	(1)	(1)
Lumber, wood products, and furniture	24,25	17,500	13,300	22,000	24,000	33,700	38,200	40,000	51,000	60,000	66,300	79,400	89,700	(1)	(1)	(1)	(1)
Paper and allied products	26	21,900	22,700	27,000	26,900	38,600	47,900	48,800	54,400	52,000	56,900	61,400	64,300	(1)	75,000	(1)	(1)
Chemicals and allied products	28	23,300	24,600	32,600	39,800	47,100	56,300	60,900	66,500	67,600	72,800	79,600	87,400	96,600	104,400	109,600	119,800
Industrial chemicals	281-82,286	27,400	28,400	34,800	43,900	54,000	63,500	67,500	74,700	79,600	84,200	92,800	103,400	118,000	124,300	126,600	137,000
Drugs and medicines	283	21,200	23,300	30,200	37,100	46,500	54,300	60,900	63,400	59,900	64,800	71,400	79,200	(1)	(1)	100,700	111,200
Other chemicals	284-85,287-89	14,200	15,300	27,900	29,800	33,400	45,300	43,200	50,800	53,800	61,600	66,500	66,500	(1)	(1)	(1)	(1)
Petroleum refining and related industries	29	29,500	32,600	35,400	41,500	57,100	74,900	81,500	87,200	97,700	106,000	120,800	130,400	(1)	(1)	(1)	(1)
Rubber products	30	22,800	18,700	26,500	30,600	53,100	58,300	54,900	56,700	57,800	61,600	(1)	(1)	(1)	(1)	72,200	78,600
Stone, clay, and glass products	32	(2)	(2)	26,000	36,800	43,600	48,200	51,200	57,800	59,800	62,900	67,200	73,800	(1)	(1)	(1)	(1)
Primary metals	33	21,000	24,000	35,700	41,000	44,700	55,900	61,500	61,300	65,200	70,000	79,300	91,000	107,700	119,000	132,000	136,600
Ferrous metals and products[3]	331-32,3398-99	21,700	24,600	37,400	42,200	44,200	54,800	59,700	65,600	70,100	73,900	83,300	93,300	(1)	(1)	(1)	(1)
Nonferrous metals and products[3]	333-36	20,000	23,200	33,500	41,200	44,800	57,100	63,300	57,500	60,500	65,600	74,000	87,700	(1)	(1)	(1)	(1)
Fabricated metal products	34	16,200	18,800	22,200	27,400	37,800	42,300	45,600	51,500	54,800	55,700	62,300	70,500	78,000	(1)	(1)	(1)
Machinery	35	25,600	27,500	31,000	37,400	48,000	57,500	58,900	62,800	68,600	72,600	78,900	89,900	93,900	102,900	110,900	126,800
Office, computing, and accounting machines	357	(4)	(4)	(4)	(4)	48,500	59,600	59,800	63,400	69,300	72,300	77,700	92,700	(1)	(1)	(1)	141,400
Other machinery, except electrical	351-56,358-59	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(1)	73,300	81,400	84,700	(1)	(1)	(1)	(1)
Electrical equipment	36	39,700	38,200	33,000	39,300	55,400	60,700	62,700	68,600	69,900	76,800	87,200	91,100	95,300	105,800	123,200	127,300
Radio and TV receiving equipment	365	(6)	(6)	(6)	47,400	26,700	44,300	47,600	52,000	96,000	72,200	80,300	93,400	(1)	(1)	90,300	99,000
Communication equipment	366	36,000	34,600	31,700	36,200	57,800	59,000	61,300	66,100	70,800	75,500	87,800	92,900	105,500	123,400	137,600	136,700
Electronic components	367					33,700	48,400	52,700	59,600	56,600	64,000	72,800	75,600	66,700	67,900	(1)	(1)
Other electrical equipment	361-64,369	42,800	41,900	35,400	45,800	59,700	67,700	68,000	74,700	74,200	85,100	94,900	98,300	(1)	(1)	(1)	(1)
Motor vehicles and motor vehicles equipment	371	49,400	53,800	49,400	54,700	68,100	89,500	91,100	103,700	111,700	115,600	122,900	135,200	147,400	162,900	185,300	211,100
Other transportation equipment	373-75,379					32,900	45,800	50,000	52,200	63,200	67,200	90,900	111,700	(1)	(1)	115,600	94,300
Aircraft and missiles	372,376	43,900	41,900	49,600	56,300	69,200	76,400	85,100	91,300	91,300	89,400	93,300	101,600	128,400	146,400	144,300	156,900
Professional and scientific instruments	38	23,500	25,600	29,900	40,000	53,200	60,700	63,900	66,700	71,700	79,400	83,800	89,700	93,400	(1)	(1)	(1)
Scientific and mechanical measuring instruments	381-82	22,600	23,100	18,400	28,100	32,600	38,400	42,200	46,800	55,800	64,700	(1)	(1)	(1)	(1)	75,700	80,900
Optical, surgical, photographic, and other instruments	383-87	24,700	29,100	37,500	44,500	62,800	71,500	75,300	77,900	81,100	89,700	98,600	103,800	(1)	(1)	145,200	156,600
Other manufacturing industries	21,27,31,39	(1)	(1)	23,700	39,100	60,600	47,800	51,900	51,700	53,400	57,200	61,900	77,400	(1)	(1)	85,800	89,400
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	(1)	(1)	31,000	38,300	45,600	52,400	49,700	56,500	63,200	76,600	83,500	86,400	77,200	75,200	71,700	73,900
Distribution by size of company (based on number of employees)																	
Less than 1,000	....	[7]11,600	12,000	18,600	25,200	32,400	36,400	40,500	45,200	44,700	47,900	53,500	56,300	56,600	60,000	62,500	66,900
1,000 to 4,999	....	[7]27,200	25,100	29,400	33,700	40,600	46,700	46,800	51,600	54,100	66,100	70,200	68,600	77,000	82,400	79,800	95,000
5,000 to 9,999	....	[7]39,400	38,700	41,400	36,700	38,800	50,000	55,300	60,300	61,600	52,200	56,100	71,400	93,700	83,400	96,200	101,600
10,000 to 24,999	....				45,800	48,700	51,800	53,700	57,500	63,500	79,400	84,100	86,200	90,900	97,300	108,500	123,200
25,000 or more	....					63,600	72,700	76,600	82,700	80,000	88,800	96,200	105,800	117,200	130,300	137,200	144,900

Note: The number of R&D scientists and engineers is derived by using the arithmetic mean of the full-time-equivalent of R&D scientists and engineers employed in the Januaries of two consecutive years.

[1] Not separately available but included in total. See general notes.
[2] Included in the other manufacturing group.
[3] SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1957-63.
[4] Data not tabulated at this level prior to 1972.
[5] Data not tabulated at this level prior to 1977.
[6] Included in the other electrical equipment group.
[7] Estimated by the National Science Foundation.

SOURCE: National Science Foundation.

Table 6.3.I

Cost per R&D scientist or engineer[1] by industry and size of company: 1984

Industry	SIC code	Companies with total employment of—					
		Total	Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total	....	$127,600	$66,900	$93,000	$101,600	$123,200	$144,900
Food and kindred products	20	(2)	70,700	96,800	108,900	(2)	(2)
Textiles and apparel	22,23	(2)	(2)	(2)	83,800	75,300	(2)
Lumber, wood products, and furniture	24,25	(2)	62,700	89,100	84,700	(2)	(2)
Paper and allied products	26	(2)	(2)	88,200	(2)	(2)	(2)
Chemicals and allied products	28	119,800	69,400	(2)	(2)	113,400	138,200
Industrial chemicals	281-82,286	137,000	(2)	(2)	(2)	120,800	146,400
Drugs and medicines	283	111,200	(2)	(2)	(2)	(2)	(2)
Other chemicals	284-85,287-89	(2)	(2)	89,000	154,200	(2)	(2)
Petroleum refining and related industries	29	(2)	74,000	121,600	(2)	(2)	165,000
Rubber products	30	78,600	54,400	(2)	(2)	(2)	(2)
Stone, clay, and glass products	32	(2)	91,900	76,000	123,400	(2)	(2)
Primary metals	33	136,600	(2)	112,900	(2)	100,400	(2)
Ferrous metals and products	331-32,3398-99	(2)	45,400	(2)	(2)	(2)	(2)
Nonferrous metals and products	333-36	(2)	(2)	(2)	102,800	(2)	235,700
Fabricated metal products	34	(2)	(2)	(2)	(2)	(2)	(2)
Machinery	35	126,800	71,600	87,900	(2)	(2)	132,200
Office, computing, and accounting machines	357	141,400	(2)	86,500	(2)	(2)	(2)
Other machinery, except electrical	351-56,358-59	(2)	(2)	89,700	(2)	(2)	(2)
Electrical equipment	36	127,300	70,500	95,800	132,000	148,000	130,800
Radio and TV receiving equipment	365	99,000	(2)	(2)	(2)	(2)	(2)
Communication equipment	366	136,700	(2)	97,200	(2)	151,300	136,800
Electronic components	367	(2)	(2)	(2)	(2)	(2)	84,500
Other electrical equipment	361-64,369	(2)	(2)	103,300	(2)	(2)	(2)
Motor vehicles and motor vehicles equipment	371	211,100	(2)	68,900	(2)	(2)	(2)
Other transportation equipment	373-75,379	94,300	(2)	90,000	(2)	(2)	(2)
Aircraft and missiles	372,376	156,900	(2)	168,700	(2)	170,400	158,400
Professional and scientific instruments	38	(2)	(2)	84,500	(2)	(2)	110,500
Scientific and mechanical measuring instruments	381-82	80,900	(2)	78,900	(2)	(2)	(2)
Optical, surgical, photographic, and other instruments	383-87	156,600	(2)	111,000	78,100	(2)	(2)
Other manufacturing industries	21,27,31,39	89,400	(2)	85,600	100,200	(2)	(2)
Nonmanufacturing industries	07-17,41-67,737, 739,807,89.1	73,900	68,400	91,500	(2)	(2)	(2)

[1] See note on table B-39.

[2] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table 6.4.I

Cost per R&D scientist or engineer[1] in companies ranked by size of R&D program: 1972 and 1974-84

Companies ranked by size of R&D program (based on total R&D funds)	1972	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
First 4	$64,500	$80,700	$90,500	$102,500	$105,200	$109,600	$121,700	$126,700	$160,200	$182,800	$185,200	$201,100
Next 4	76,300	80,500	84,000	87,600	94,600	103,800	105,700	119,200	138,900	127,600	154,000	167,000
Next 12	63,100	76,900	80,600	82,900	79,300	83,800	90,500	93,300	107,000	127,500	119,300	120,900
Next 20	57,500	62,200	66,400	68,200	75,900	80,800	87,600	97,600	101,700	104,200	117,800	121,000
Next 60	51,000	66,200	61,400	65,200	69,900	74,200	80,100	90,700	96,600	98,000	118,800	127,200
Next 100	41,600	49,900	52,600	53,400	57,200	58,700	63,400	71,600	87,900	99,200	96,300	106,100
Next 200	39,700	44,000	43,600	48,300	54,200	56,900	61,200	72,800	79,900	86,900	86,400	94,700
Average of above 400 R&D performing companies	57,200	66,900	70,400	74,300	78,100	82,200	88,500	96,600	114,400	118,500	125,400	133,300
Average of R&D performing companies less above 400	28,300	32,800	40,100	44,000	44,900	46,200	47,400	56,300	58,600	65,100	86,600	71,000

SOURCE: National Science Foundation.

Table 6.5.I

R&D scientists and engineers per 1,000 employees by industry and size of company: 1958, 1961, 1967, 1972, and 1974-84

Industry and size of company	SIC code	1958	1961	1967	1972	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Distribution by industry																
Total	....	21	28	27	26	25	26	27	27	27	27	27	29	33	35	36
Food and kindred products	20	6	7	7	7	7	7	7	7	7	6	5	6	6	6	7
Textiles and apparel	22,23	1	3	3	3	3	3	3	3	3	3	3	3	4	4	4
Lumber, wood products, and furniture	24,25	5	4	4	6	7	7	7	7	7	6	6	(1)	(1)	(1)	(1)
Paper and allied products	26	6	6	6	8	8	10	12	12	14	14	14	16	16	16	16
Chemicals and allied products	28	39	40	36	39	40	41	40	42	43	42	42	44	51	54	53
Industrial chemicals	281-82,286	42	40	33	34	37	38	36	38	38	36	36	37	44	45	42
Drugs and medicines	283	46	47	51	60	57	59	64	62	65	62	60	66	74	(1)	(1)
Other chemicals	284-85,287-89	30	38	33	31	30	29	28	29	27	27	30	33	36	36	36
Petroleum refining and related industries	29	15	17	18	16	18	19	17	17	19	18	17	20	22	22	21
Rubber products	30	19	20	17	16	17	18	18	19	18	(1)	(1)	25	(1)	(1)	(1)
Stone, clay, and glass products	32	(1)	12	14	10	11	11	11	12	13	13	13	13	14	14	16
Primary metals	33	5	5	5	5	5	7	8	8	8	7	7	8	10	11	11
Ferrous metals and products[2]	331-32,3398-99	4	4	4	4	4	5	5	5	6	6	6	6	8	10	9
Nonferrous metals and products[2]	333-36	6	8	8	7	7	11	15	13	12	12	12	13	14	15	15
Fabricated metal products	34	16	15	14	10	11	12	12	12	12	12	14	15	(1)	(1)	(1)
Machinery	35	22	28	28	31	34	36	38	38	39	38	36	35	45	51	48
Office, computing, and accounting machines	357	(3)	(3)	(3)	66	69	76	79	78	79	75	72	71	75	78	(1)
Other machinery, except electrical	351-56,358-59	(4)	(4)	(4)	(4)	(4)	(4)	(4)	18	19	19	18	19	26	30	27
Electrical equipment	36	43	55	43	37	37	40	42	42	41	43	44	48	56	52	48
Radio and TV receiving equipment	365	(5)	(5)	18	26	18	16	15	17	22	29	35	51	(1)	(1)	(1)
Communication equipment	366	52	67	52	42	43	44	45	46	48	53	55	56	73	60	52
Electronic components	367				39	40	49	55	54	51	52	55	66	67	(1)	(1)
Other electrical equipment	361-64,369	37	41	35	31	32	36	38	35	32	32	32	34	(1)	(1)	37
Motor vehicles and motor vehicles equipment	371	16	19	20	23	24	25	25	24	26	26	30	30	31	30	27
Other transportation equipment	373-75,379				14	13	13	14	13	13	11	9	9	10	(1)	(1)
Aircraft and missiles	372,376	72	99	89	76	72	72	78	85	96	93	92	98	99	106	107
Professional and scientific instruments	38	44	36	32	33	35	38	41	41	42	41	39	46	(1)	(1)	(1)
Scientific and mechanical measuring instruments	381-82	57	38	26	31	35	41	45	45	50	(1)	(1)	(1)	(1)	(1)	(1)
Optical, surgical, photographic, and other instruments	383-87	33	35	35	34	35	37	38	41	44	45	48	47	(1)	(1)	(1)
Other manufacturing industries	21,27,31,39	(1)	9	6	6	6	7	8	7	9	7	7	7	9	(1)	(1)
Nonmanufacturing industries	07-17,41-67,737, 739,807,891		9	13	21	17	16	19	16	14	13	11	12	13	16	19
Distribution by size of company (based on number of employees)																
Less than 1,000	....	18	27	28	28	29	26	25	24	25	24	25	28	30	35	39
1,000 to 4,999	....	12	19	16	19	17	17	17	17	18	18	19	21	22	26	26
5,000 to 9,999	....	25	31	15	19	18	17	19	20	17	19	19	18	23	23	24
10,000 to 24,999	....			31	16	16	17	18	19	20	19	20	23	26	27	28
25,000 or more	....				31	33	35	34	35	34	34	34	36	43	42	42

Note: The number of R&D scientists and engineers for 1983 is derived by dividing the arithmetic mean of scientists and engineers employed in January 1982 and January 1983 by the number of company employees in all activities in March 1982. Similar procedures were used in earlier years except 1967-69 in which data were derived by dividing the worker-years of R&D scientists and engineers for the year by the March employment figures.

[1] Not separately available but included in total. See general notes.
[2] SIC codes 3398 and 3399 included in the nonferrous metals products group for 1958-61.
[3] Data not tabulated at this level prior to the 1972 survey.
[4] Data not tabulated at this level prior to the 1977 survey.
[5] Included in the other electrical equipment group for 1958-61.

SOURCE: National Science Foundation.

Table 6.6.I

Total employment of R&D-performing companies by industry and size of company: 1983-84

[In thousands]

Industry	SIC code	1983						1984					
			Companies with total employment of--						Companies with total employment of--				
		Total	Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more	Total	Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total	....	15,229	1,369	1,746	1,298	3,040	7,776	15,722	1,352	1,765	1,311	3,042	8,252
Food and kindred products	20	1,195	98	115	178	278	525	1,158	69	110	167	273	538
Textiles and apparel	22,23	538	93	83	81	167	113	531	93	83	82	162	111
Lumber, wood products, and furniture	24,25	273	30	64	52	(1)	(1)	288	31	67	58	(1)	(1)
Paper and allied products	26	504	17	76	45	191	174	498	16	69	46	178	189
Chemicals and allied products	28	1,243	85	136	85	390	546	1,261	87	137	83	388	566
Industrial chemicals	281-82,286	596	20	32	53	76	415	615	20	34	51	77	433
Drugs and medicines	283	357	13	38	(1)	203	(1)	348	14	34	(1)	196	(1)
Other chemicals	284-85,287-89	289	51	66	(1)	112	(1)	298	53	69	(1)	116	(1)
Petroleum refining and related industries	29	622	7	15	15	101	484	621	7	14	15	95	491
Rubber products	30	399	106	63	27	72	132	413	107	64	29	77	137
Stone, clay, and glass products	32	342	51	37	(1)	146	(1)	349	50	37	(1)	154	(1)
Primary metals	33	758	43	104	75	203	333	768	43	107	73	188	337
Ferrous metals and products	331-32,3398-99	546	22	67	(1)	109	(1)	540	22	70	(1)	95	(1)
Nonferrous metals and products	333-36	212	21	37	(1)	94	(1)	208	21	37	(1)	93	(1)
Fabricated metal products	34	449	101	100	95	70	83	455	98	102	99	70	86
Machinery	35	1,495	224	261	104	277	628	1,594	236	283	110	298	667
Office, computing, and accounting machines	357	642	34	63	13	63	468	678	34	70	12	62	498
Other machinery, except electrical	351-56,358-59	853	190	198	91	214	159	917	202	213	97	236	169
Electrical equipment	36	2,173	143	177	124	296	1,433	2,455	155	191	138	305	1,665
Radio and TV receiving equipment	365	197	13	11	(1)	(1)	(1)	191	13	11	(1)	(1)	(1)
Communication equipment	366	867	29	37	26	96	679	1,095	33	39	29	99	895
Electronic components	367	361	44	44	29	47	197	401	50	52	35	54	209
Other electrical equipment	361-64,369	748	56	86	(1)	(1)	(1)	768	59	90	(1)	(1)	(1)
Motor vehicles and motor vehicles equipment	371	948	22	36	31	95	764	1,070	25	41	37	106	861
Other transportation equipment	373-75,379	163	10	27	(1)	(1)	105	134	6	20	(1)	(1)	(1)
Aircraft and missiles	372,376	906	15	20	20	89	763	954	15	21	17	91	810
Professional and scientific instruments	38	625	95	74	49	92	315	628	98	76	45	87	322
Scientific and mechanical measuring instruments	381-82	280	51	45	(1)	(1)	129	302	56	47	(1)	(1)	144
Optical, surgical, photographic, and other instruments	383-87	345	44	29	(1)	(1)	186	326	42	29	(1)	(1)	178
Other manufacturing industries	21,27,31,39	687	78	110	75	156	267	676	78	109	77	156	256
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	1,908	150	246	184	365	963	1,888	136	235	179	358	981

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table 6.1.C

FEDERAL OBLIGATIONS TO UNIVERSITIES AND COLLEGES FOR RESEARCH AND DEVELOPMENT BY DETAILED FIELD AND AGENCY: FISCAL YEAR 1985

(DOLLARS IN THOUSANDS)

FIELD OF SCIENCE/ENGINEERING	TOTAL	USDA	COM	DOD	ED	DOE	EPA	HHS	INT	NASA	NSF	OTHER 1/
TOTAL, ALL FIELDS	6,379,151	302,719	77,585	1,040,754	69,558	373,071	61,877	3,098,649	32,876	237,260	1,011,133	73,669
ENGINEERING, TOTAL	1,075,550	9,970	1,664	723,622	2,693	82,784	5,887	31,146	9,777	51,937	149,921	6,149
AERONAUTICAL	39,903	0	0	20,325	0	0	55	0	0	18,771	752	0
ASTRONAUTICAL	14,765	0	0	11,064	0	0	0	0	0	3,630	71	0
CHEMICAL	68,602	0	250	2,865	0	37,291	520	0	0	876	26,800	0
CIVIL	45,368	645	237	5,939	0	365	2,966	0	218	374	31,259	3,365
ELECTRICAL	231,457	0	152	193,307	0	298	99	0	46	6,149	31,406	0
MECHANICAL	53,214	0	275	18,474	0	8,685	0	0	0	6,523	18,741	516
METALLURGY & MATERIALS	80,416	0	381	19,803	0	15,885	0	0	9,513	7,656	27,178	0
ENGINEERING, NEC	541,825	9,325	369	451,845	2,693	20,260	2,247	31,146	0	7,958	13,714	2,268
ALL SCIENCES, TOTAL	5,303,601	292,749	75,921	317,132	66,865	290,287	55,990	3,067,503	23,099	185,323	861,212	67,520
PHYSICAL SCIENCES, TOTAL	789,184	15,589	4,110	79,096	0	207,386	2,514	83,651	2,524	87,613	306,451	250
ASTRONOMY	78,654	0	1,349	2,042	0	0	0	0	0	48,635	26,628	0
CHEMISTRY	256,156	15,589	915	25,544	0	25,262	1,388	81,116	2,524	4,128	99,585	105
PHYSICS	397,061	0	1,846	48,325	0	181,385	411	2,535	0	23,325	139,089	145
PHYSICAL SCIENCES, NEC	57,313	0	0	3,185	0	739	715	0	0	11,525	41,149	0
MATHEMATICAL SCIENCES 2/	94,680	3,774	126	25,273	0	11,460	110	4,818	0	2,533	46,586	0
COMPUTER SCIENCES	79,637	378	989	15,668	0	7,969	242	0	109	6,586	45,925	1,771
ENVIRONMENTAL SCIENCES, TOTAL	451,303	2,057	64,970	67,644	0	21,682	24,248	0	12,372	64,085	190,433	3,812
ATMOSPHERIC SCIENCES	135,562	1,713	20,531	24,024	0	3,671	187	0	2,097	35,712	47,506	121
GEOLOGICAL SCIENCES	116,592	344	0	5,123	0	9,212	4,075	0	4,907	19,080	70,280	3,571
OCEANOGRAPHY	138,704	0	44,323	37,529	0	7,061	45	0	566	3,653	45,527	0
ENVIRONMENTAL SCIENCES, NEC	60,445	0	116	968	0	1,738	19,941	0	4,802	5,640	27,120	120
LIFE SCIENCES, TOTAL	3,365,004	242,844	292	76,913	23,976	39,630	21,622	2,708,110	7,391	20,001	172,071	52,154
BIOLOGICAL (EXCL. ENV BIO)	1,770,759	46,928	106	18,987	0	27,127	15,975	1,511,974	774	9,371	139,517	0
ENVIRONMENTAL BIOLOGY	80,383	42,472	0	1,955	0	170	674	576	3,444	694	30,398	0
AGRICULTURAL	181,443	139,732	186	1,244	0	298	484	543	3,173	932	0	34,851
MEDICAL	1,288,203	13,712	0	54,295	960	7,730	1,456	1,189,299	0	3,111	337	17,303
LIFE SCIENCES, NEC	44,216	0	0	432	23,016	4,305	3,033	5,718	0	5,893	1,819	0
PSYCHOLOGY, TOTAL	133,786	0	20	10,767	0	0	275	105,115	13	2,151	12,155	3,290
BIOLOGICAL ASPECTS	39,700	0	0	119	0	0	275	30,566	0	227	8,428	85
SOCIAL ASPECTS	36,205	0	0	10,445	0	0	0	20,268	13	353	3,619	1,507
PSYCHOLOGY, NEC	57,881	0	20	203	0	0	0	54,281	0	1,571	108	1,698
SOCIAL SCIENCES, TOTAL	175,909	28,107	4,946	2,466	42,889	0	1,065	58,945	353	84	31,066	5,988
ANTHROPOLOGY	6,053	0	0	0	0	0	0	426	90	0	5,537	0
ECONOMICS	45,292	21,037	4,946	680	0	0	533	4,506	25	3	9,372	4,190
HISTORY	1,494	0	0	0	0	0	0	32	0	0	1,462	0
LINGUISTICS	3,196	0	0	0	0	0	0	145	0	0	3,051	0
POLITICAL SCIENCE	6,216	0	0	430	0	0	392	1,646	0	0	3,748	0
SOCIOLOGY	34,887	7,070	0	12	0	0	0	21,789	238	0	4,255	1,523
SOCIAL SCIENCES, NEC	78,771	0	0	1,344	42,889	0	140	30,401	0	81	3,641	275
OTHER SCIENCES, NEC	214,098	0	468	39,305	0	2,160	5,914	106,864	337	2,270	56,525	255

1/ INCLUDES DOT, AID, HUD, LABOR, AND NRC.
2/ INCLUDES DATA PREVIOUSLY CLASSIFIED AS "MATHEMATICAL/COMPUTER SCIENCES, NEC".

SOURCE: NATIONAL SCIENCE FOUNDATION

Table 6.2.C

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FEDERAL OBLIGATIONS FOR RESEARCH PERFORMED AT UNIVERSITIES AND COLLEGES, BY AGENCY AND FIELD OF SCIENCE/ENGINEERING:
FISCAL YEAR 1985

(THOUSANDS OF DOLLARS)

AGENCY AND SUBDIVISION	TOTAL	LIFE SCIENCES	PSY-CHOLOGY	PHYSICAL SCIENCES	ENVIRON-MENTAL SCIENCES	MATHE-MATICS AND COM-PUTER SCIENCES	ENGI-NEERING	SOCIAL SCIENCES	OTHER SCIENCES NEC
TOTAL, ALL AGENCIES	5.410.957	3.192.191	131.972	749,716	361.141	253.089	507.062	124.709	91.077
DEPARTMENTS				-					
DEPARTMENT OF AGRICULTURE, TOTAL	292.155	232.567	-	15.548	2.055	1.328	9.888	30.769	-
AGRICULTURAL COOPERATIVE SERVICE ...	644	-	-	-	-	-	-	644	-
AGRICULTURAL MARKETING SERVICE	344	344	-	-	-	-	-	-	-
AGRICULTURAL RESEARCH SERVICE	16.626	15.303	-	-	-	394	924	5	-
COOPERATIVE STATE RESEARCH SERVICE .	263.618	211.064	-	15.548	1,252	-	8,964	26.790	-
ECONOMIC RESEARCH SERVICE	2,800	-	-	-	-	-	-	2,800	-
FEDERAL GRAIN INSPECTION SERVICE ...	84	84	-	-	-	-	-	-	-
FOREST SERVICE	6.624	4,997	-	-	803	294	-	530	-
HUMAN NUTRITION INFORMATION SERVICE	703	703	-	-	-	-	-	-	-
OFFICE OF TRANSPORTATION	72	72	-	-	-	-	-	-	-
STATISTICAL REPORTING SERVICE	640	-	-	-	-	640	-	-	-
DEPARTMENT OF DEFENSE, TOTAL	587,152	64.400	21,754	90,374	73,307	132,366	192,621	62	12,268
DEPARTMENT OF THE ARMY	117.248	30,724	3.449	18.820	9.593	11,889	31.276	38	11.459
DEPARTMENT OF THE NAVY	188.105	21.277	10,667	34.402	47.245	19.563	54.951	-	-
DEPARTMENT OF THE AIR FORCE	158.832	9.253	6.375	34.964	12.420	14.141	81.679	-	-
DEFENSE AGENCIES	122.967	3.146	1,263	2.188	4,049	86.773	24.715	24	809
DEPARTMENT OF ENERGY	335.882	39.507	-	207.151	19.269	17.359	52.479	-	117
DEPT OF HLTH & HUMAN SERVICES, TOTAL .	2.980.541	2.651.984	96.601	74,179	-	5.262	32.849	60.459	59.207
ALCOHOL, DRUG ABUSE & MENTAL HLTH ADMIN	183.540	106.545	52.329	558	-	256	-	20.929	2.923
CENTERS FOR DISEASE CONTROL	6.733	6.733	-	-	-	-	-	-	-
FOOD & DRUG ADMINISTRATION	3.565	3.565	-	-	-	-	-	-	-
HEALTH CARE FINANCING ADMIN	8.913	-	-	-	-	-	-	8,913	-
HEALTH RESOURCES AND SERVICES ADMINISTRATION	14.112	4.883	-	-	-	-	-	-	9,229
HUMAN DEVELOPMENT SERVICES	1.335	-	-	-	-	-	-	1.335	-
NATIONAL INSTITUTES OF HEALTH 1/....	2.754.319	2.530.258	44.057	73.621	-	5.006	32.849	21.473	47.055
OFFICE OF ASST'T SECY FOR HEALTH ...	4,200	-	-	-	-	-	-	4,200	-
OFFICE OF THE SECRETARY	2,728	-	-	-	-	-	-	2.728	-
SOCIAL SECURITY ADMINISTRATION	1.096	-	215	-	-	-	-	881	-
OTHER AGENCIES									
NATIONAL AERONAUTICS & SPACE ADMIN ...	213.421	19.977	2.151	71.432	59.196	8.716	49.644	84	2.221
NATIONAL SCIENCE FOUNDATION	1,001.806	183.756	11.466	291.032	207.314	88.058	169.581	33.335	17.264

1/ DETAILED NIH DATA FOR FY 1985, 1986, AND 1987 WERE UNAVAILABLE AT THE TIME OF PUBLICATION. FIELD OF SCIENCE/ENGINEERING, PERFORMER, AND GEOGRAPHIC DATA WERE ESTIMATED BY NSF.

NOTE: THE RESEARCH OBLIGATIONS OF THE SIX AGENCIES INCLUDED IN THIS TABLE REPRESENT APPROXIMATELY 95 PERCENT OF TOTAL FEDERAL RESEARCH OBLIGATIONS TO UNIVERSITIES AND COLLEGES IN FY 1985.

SOURCE: NATIONAL SCIENCE FOUNDATION

Table 6.3.C

FEDERAL OBLIGATIONS FOR RESEARCH PERFORMED AT UNIVERSITIES AND COLLEGES IN PHYSICAL AND ENVIRONMENTAL SCIENCES, BY AGENCY AND DETAILED FIELD OF SCIENCE/ENGINEERING: FISCAL YEAR 1985

(THOUSANDS OF DOLLARS)

AGENCY AND SUBDIVISION	PHYSICAL SCIENCES					ENVIRONMENTAL SCIENCES				
	TOTAL	ASTRONOMY	CHEMISTRY	PHYSICS	PHYSICAL SCIENCES NEC	TOTAL	ATMOSPHERIC	GEOLOGICAL	OCEANOGRAPHY	ENVIRONMENTAL SCIENCES NEC
TOTAL, ALL AGENCIES	749.716	65.908	266.823	401.809	15.176	361,141	102.816	98,621	150.039	9.665
DEPARTMENTS										
DEPARTMENT OF AGRICULTURE, TOTAL	15.548	-	15.548	-	-	2,055	1,711	344	-	-
COOPERATIVE STATE RESEARCH SERVICE	15.548	-	15.548	-	-	1,252	1,252	-	-	-
FOREST SERVICE	-	-	-	-	-	803	459	344	-	-
DEPARTMENT OF DEFENSE, TOTAL	90,374	4,722	40.415	43,584	1.653	73,307	16.949	18.960	36.795	603
DEPARTMENT OF THE ARMY	18.820	-	10.885	6.961	974	9.593	4.140	4.765	85	603
DEPARTMENT OF THE NAVY	34.402	-	15.529	18.873	-	47,245	2.348	9,000	35.897	-
DEPARTMENT OF THE AIR FORCE	34,964	4.722	14.001	16,050	191	12,420	10,461	1,959	-	-
DEFENSE AGENCIES	2.188	-	-	1,700	488	4,049	-	3.236	813	-
DEPARTMENT OF ENERGY	207,151	-	26.018	180.721	412	19,269	4,094	8,989	5.066	1.120
DEPT OF HLTH & HUMAN SERVICES, TOTAL	74,179	-	72,599	1.580	-	-	-	-	-	-
ALCOHOL, DRUG ABUSE & MENTAL HLTH ADMIN	558	-	558	-	-	-	-	-	-	-
NATIONAL INSTITUTES OF HEALTH 1/	73,621	-	72,041	1.580	-	-	-	-	-	-
OTHER AGENCIES										
NATIONAL AERONAUTICS & SPACE ADMIN	71.432	34,049	4.128	22,442	10,813	59,196	30,823	19,080	3.653	5.640
NATIONAL SCIENCE FOUNDATION	291,032	27.137	108,115	153,482	2,298	207,314	49,239	51,248	104,525	2.302

1/ DETAILED NIH DATA FOR FY 1985, 1986, AND 1987 WERE UNAVAILABLE AT THE TIME OF PUBLICATION. FIELD OF SCIENCE/ENGINEERING, PERFORMER, AND GEOGRAPHIC DATA WERE ESTIMATED BY NSF.

NOTE: THE RESEARCH OBLIGATIONS OF THE SIX AGENCIES INCLUDED IN THIS TABLE REPRESENT APPROXIMATELY 95 PERCENT OF TOTAL FEDERAL RESEARCH OBLIGATIONS TO UNIVERSITIES AND COLLEGES IN FY 1985.

SOURCE: NATIONAL SCIENCE FOUNDATION

Table 6.4.C

FEDERAL OBLIGATIONS FOR RESEARCH PERFORMED AT UNIVERSITIES AND COLLEGES IN ENGINEERING,
BY AGENCY AND DETAILED FIELD OF SCIENCE/ENGINEERING: FISCAL YEAR 1986 (ESTIMATED)

(THOUSANDS OF DOLLARS)

AGENCY AND SUBDIVISION	ENGINEERING								
	TOTAL	AERO-NAUTICAL	ASTRO-NAUTICAL	CHEMICAL	CIVIL	ELEC-TRICAL	MECHAN-ICAL	METAL-LURGY AND MATERIALS	ENGI-NEERING NEC
TOTAL, ALL AGENCIES	558,954	59,171	10,635	48,792	38,132	126,148	70,284	125,884	79,908
DEPARTMENTS									
DEPARTMENT OF AGRICULTURE, TOTAL	9,169	-	-	-	346	-	260	-	8,563
AGRICULTURAL RESEARCH SERVICE	526	-	-	-	346	-	180	-	-
COOPERATIVE STATE RESEARCH SERVICE	8,563	-	-	-	-	-	-	-	8,563
FEDERAL GRAIN INSPECTION SERVICE	80	-	-	-	-	-	80	-	-
DEPARTMENT OF DEFENSE, TOTAL	236,038	36,568	7,345	1,985	5,129	82,044	32,786	62,076	8,105
DEPARTMENT OF THE ARMY	31,514	4,581	9	927	2,703	9,623	4,641	8,151	879
DEPARTMENT OF THE NAVY	58,744	18	-	711	15	24,316	19,574	14,110	-
DEPARTMENT OF THE AIR FORCE	95,114	25,844	7,336	347	2,411	39,914	8,571	10,032	659
DEFENSE AGENCIES	50,666	6,125	-	-	-	8,191	-	29,783	6,567
DEPARTMENT OF ENERGY	46,866	-	-	15,966	639	638	7,212	16,041	6,370
DEPT OF HLTH & HUMAN SERVICES, TOTAL	33,612	-	-	-	-	-	-	-	33,612
NATIONAL INSTITUTES OF HEALTH 1/	33,612	-	-	-	-	-	-	-	33,612
OTHER AGENCIES									
NATIONAL AERONAUTICS & SPACE ADMIN	59,385	21,949	3,290	807	447	6,549	7,742	9,159	9,442
NATIONAL SCIENCE FOUNDATION	173,884	654	-	30,034	31,571	36,917	22,284	38,608	13,816

1/ DETAILED NIH DATA FOR FY 1985, 1986, AND 1987 WERE UNAVAILABLE AT THE TIME OF PUBLICATION. FIELD OF SCIENCE/ENGINEERING, PERFORMER, AND GEOGRAPHIC DATA WERE ESTIMATED BY NSF.

NOTE: THE RESEARCH OBLIGATIONS OF THE SIX AGENCIES INCLUDED IN THIS TABLE REPRESENT APPROXIMATELY 96 PERCENT OF TOTAL FEDERAL RESEARCH OBLIGATIONS TO UNIVERSITIES AND COLLEGES IN FY 1986.

SOURCE: NATIONAL SCIENCE FOUNDATION

Table 6.5.C

FEDERAL OBLIGATIONS FOR APPLIED RESEARCH PERFORMED AT UNIVERSITIES AND COLLEGES, BY DETAILED FIELD OF SCIENCE/ENGINEERING: FISCAL YEARS 1985, 1986, AND 1987

(THOUSANDS OF DOLLARS)

FIELD OF SCIENCE/ENGINEERING	ACTUAL, 1985	ESTIMATES	
		1986	1987
TOTAL, ALL FIELDS	1,436,932	1,469,940	1,414,355
LIFE SCIENCES, TOTAL	885,431	909,616	857,290
BIOLOGICAL (EXCLUDING ENVIRONMENTAL)	311,180	325,115	303,690
ENVIRONMENTAL BIOLOGY	36,450	34,257	32,685
AGRICULTURAL	51,990	47,526	42,396
MEDICAL	454,562	470,566	447,948
LIFE SCIENCES, NEC	31,249	32,152	30,571
PSYCHOLOGY, TOTAL	56,553	60,176	56,655
BIOLOGICAL ASPECTS	18,466	20,016	19,068
SOCIAL ASPECTS	12,917	14,794	11,681
PSYCHOLOGICAL SCIENCES, NEC	25,170	25,366	25,906
PHYSICAL SCIENCES, TOTAL	120,929	110,567	102,828
ASTRONOMY	678	919	978
CHEMISTRY	31,973	31,788	27,732
PHYSICS	84,818	73,675	67,518
PHYSICAL SCIENCES, NEC	3,460	4,185	6,600
ENVIRONMENTAL SCIENCES, TOTAL	30,452	30,057	29,832
ATMOSPHERIC	13,109	12,814	12,502
GEOLOGICAL	8,856	9,510	9,438
OCEANOGRAPHY	5,061	4,291	3,855
ENVIRONMENTAL SCIENCES, NEC	3,426	3,442	4,037
MATHEMATICS & COMPUTER SCIENCES, TOTAL	80,962	100,750	136,172
MATHEMATICS	12,174	13,138	4,804
COMPUTER SCIENCES	28,657	32,722	45,678
MATHEMATICS & COMPUTER SCIENCES, NEC	40,131	54,890	85,690
ENGINEERING, TOTAL	140,435	139,213	129,808
AERONAUTICAL	12,627	15,243	15,501
ASTRONAUTICAL	6,668	4,994	4,945
CHEMICAL	18,021	18,906	10,011
CIVIL	9,920	8,236	8,766
ELECTRICAL	33,984	33,743	31,806
MECHANICAL	11,803	14,495	13,774
METALLURGY & MATERIALS	11,330	9,551	12,326
ENGINEERING, NEC	36,082	34,045	32,679
SOCIAL SCIENCES, TOTAL	72,339	64,760	60,076
ANTHROPOLOGY	676	620	644
ECONOMICS	22,400	19,474	18,516
POLITICAL SCIENCE	1,313	1,205	1,203
SOCIOLOGY	15,465	14,997	13,972
SOCIAL SCIENCES, NEC	32,485	28,464	25,741
OTHER SCIENCES, NEC	49,831	54,801	41,694

NOTE: THE APPLIED RESEARCH OBLIGATIONS OF THE SIX AGENCIES INCLUDED IN THIS TABLE REPRESENT APPROXIMATELY 88 PERCENT OF TOTAL FEDERAL APPLIED RESEARCH OBLIGATIONS TO UNIVERSITIES AND COLLEGES IN FY 1985, 1986, AND 1987.

SOURCE: NATIONAL SCIENCE FOUNDATION

Table 6.6.C

FEDERAL OBLIGATIONS FOR APPLIED RESEARCH PERFORMED AT UNIVERSITIES AND COLLEGES IN PHYSICAL AND ENVIRONMENTAL SCIENCES, BY AGENCY AND DETAILED FIELD OF SCIENCE/ENGINEERING: FISCAL YEAR 1985

(THOUSANDS OF DOLLARS)

AGENCY AND SUBDIVISION	PHYSICAL SCIENCES					ENVIRONMENTAL SCIENCES				
	TOTAL	ASTRONOMY	CHEMISTRY	PHYSICS	PHYSICAL SCIENCES NEC	TOTAL	ATMOSPHERIC	GEOLOGICAL	OCEANOGRAPHY	ENVIRONMENTAL SCIENCES NEC
TOTAL, ALL AGENCIES	120,929	678	31,973	84,818	3,460	30,452	13,109	8,856	5,061	3,426
DEPARTMENTS										
DEPARTMENT OF AGRICULTURE, TOTAL	9,297	-	9,297	-	-	1,510	1,295	215	-	-
COOPERATIVE STATE RESEARCH SERVICE	9,297	-	9,297	-	-	848	848	-	-	-
FOREST SERVICE	-	-	-	-	-	662	447	215	-	-
DEPARTMENT OF DEFENSE, TOTAL	17,011	-	3,742	11,798	1,471	7,626	4,267	2,150	663	546
DEPARTMENT OF THE ARMY	3,146	-	2,213	141	792	1,929	874	444	65	546
DEPARTMENT OF THE NAVY	6,526	-	108	6,418	-	429	301	-	128	-
DEPARTMENT OF THE AIR FORCE	5,151	-	1,421	3,539	191	3,566	3,092	474	-	-
DEFENSE AGENCIES	2,188	-	-	1,700	488	1,702	-	1,232	470	-
DEPARTMENT OF ENERGY	62,384	-	2,952	59,112	320	11,918	3,782	3,952	3,634	550
DEPT OF HLTH & HUMAN SERVICES, TOTAL	13,825	-	13,447	378	-	-	-	-	-	-
ALCOHOL, DRUG ABUSE & MENTAL HLTH ADMIN	313	-	313	-	-	-	-	-	-	-
NATIONAL INSTITUTES OF HEALTH 1/	13,512	-	13,134	378	-	-	-	-	-	-
OTHER AGENCIES										
NATIONAL AERONAUTICS & SPACE ADMIN	8,402	678	182	5,873	1,669	6,353	2,969	1,415	-	1,969
NATIONAL SCIENCE FOUNDATION	10,010	-	2,353	7,657	-	3,045	796	1,124	764	361

DETAILED NIH DATA FOR FY 1985, 1986, AND 1987 WERE UNAVAILABLE AT THE TIME OF PUBLICATION. FIELD OF SCIENCE/ENGINEERING, PERFORMER, AND GEOGRAPHIC DATA WERE ESTIMATED BY NSF.

NOTE: THE APPLIED RESEARCH OBLIGATIONS OF THE SIX AGENCIES INCLUDED IN THIS TABLE REPRESENT APPROXIMATELY 87 PERCENT OF TOTAL FEDERAL APPLIED RESEARCH OBLIGATIONS TO UNIVERSITIES AND COLLEGES IN FY 1985.

SOURCE: NATIONAL SCIENCE FOUNDATION

Table 6.7.C

FEDERAL OBLIGATIONS FOR APPLIED RESEARCH PERFORMED AT UNIVERSITIES AND COLLEGES IN PHYSICAL AND ENVIRONMENTAL SCIENCES, BY AGENCY AND DETAILED FIELD OF SCIENCE/ENGINEERING: FISCAL YEAR 1986 (ESTIMATED)

(THOUSANDS OF DOLLARS)

AGENCY AND SUBDIVISION	PHYSICAL SCIENCES					ENVIRONMENTAL SCIENCES				
	TOTAL	ASTRONOMY	CHEMISTRY	PHYSICS	PHYSICAL SCIENCES NEC	TOTAL	ATMOSPHERIC	GEOLOGICAL	OCEANOGRAPHY	ENVIRONMENTAL SCIENCES NEC
TOTAL, ALL AGENCIES	110.567	919	31.788	73.675	4.185	30.057	12.814	9.510	4.291	3.442
DEPARTMENTS										
DEPARTMENT OF AGRICULTURE, TOTAL	8.827	-	8.827	-	-	1.849	1.469	380	-	-
COOPERATIVE STATE RESEARCH SERVICE	8.827	-	8.827	-	-	685	685	-	-	-
FOREST SERVICE	-	-	-	-	-	1,164	784	380	-	-
DEPARTMENT OF DEFENSE, TOTAL	13.237	108	3.369	7.857	1.903	7.505	4.112	2.133	749	511
DEPARTMENT OF THE ARMY	2.401	-	1.626	501	274	1.594	625	404	54	511
DEPARTMENT OF THE NAVY	3.940	108	212	3.003	617	158	158	-	-	-
DEPARTMENT OF THE AIR FORCE	5.546	-	1.531	3.810	205	3.840	3.329	511	-	-
DEFENSE AGENCIES	1.350	-	-	543	807	1.913	-	1.218	695	-
DEPARTMENT OF ENERGY	54.239	-	3.099	50.854	286	10.732	3.177	4.867	2.541	147
DEPT OF HLTH & HUMAN SERVICES, TOTAL	14,444	-	14,048	396	-	-	-	-	-	-
ALCOHOL, DRUG ABUSE & MENTAL HLTH ADMIN	324	-	324	-	-	-	-	-	-	-
NATIONAL INSTITUTES OF HEALTH 1/	14,120	-	13.724	396	-	-	-	-	-	-
OTHER AGENCIES										
NATIONAL AERONAUTICS & SPACE ADMIN	10,050	811	218	7.025	1.996	7.599	3.551	1.693	-	2.355
NATIONAL SCIENCE FOUNDATION	9.770	-	2.227	7.543	-	2.372	505	437	1.001	429

1/ DETAILED NIH DATA FOR FY 1985, 1986, AND 1987 WERE UNAVAILABLE AT THE TIME OF PUBLICATION. FIELD OF SCIENCE/ENGINEERING, PERFORMER, AND GEOGRAPHIC DATA WERE ESTIMATED BY NSF.

NOTE: THE APPLIED RESEARCH OBLIGATIONS OF THE SIX AGENCIES INCLUDED IN THIS TABLE REPRESENT APPROXIMATELY 87 PERCENT OF TOTAL FEDERAL APPLIED RESEARCH OBLIGATIONS TO UNIVERSITIES AND COLLEGES IN FY 1986.

SOURCE: NATIONAL SCIENCE FOUNDATION

Table 6.8.C

FEDERAL OBLIGATIONS FOR APPLIED RESEARCH PERFORMED AT UNIVERSITIES AND COLLEGES IN ENGINEERING, BY AGENCY AND DETAILED FIELD OF SCIENCE/ENGINEERING: FISCAL YEAR 1986 (ESTIMATED)

(THOUSANDS OF DOLLARS)

AGENCY AND SUBDIVISION	ENGINEERING								
	TOTAL	AERO-NAUTICAL	ASTRO-NAUTICAL	CHEMICAL	CIVIL	ELEC-TRICAL	MECHAN-ICAL	METAL-LURGY AND MATERIALS	ENGI-NEERING NEC
TOTAL, ALL AGENCIES	139.213	15.243	4,994	18.906	8.236	33.743	14,495	9.551	34,045
DEPARTMENTS									
DEPARTMENT OF AGRICULTURE, TOTAL	6.830	-	-	-	149	-	158	-	6,523
AGRICULTURAL RESEARCH SERVICE	227	-	-	-	149	-	78	-	-
COOPERATIVE STATE RESEARCH SERVICE	6.523	-	-	-	-	-	-	-	6,523
FEDERAL GRAIN INSPECTION SERVICE	80	-	-	-	-	-	80	-	-
DEPARTMENT OF DEFENSE, TOTAL	58.963	10,272	4.758	1,000	2.762	25,468	6.756	6.002	1,945
DEPARTMENT OF THE ARMY	6.896	132	9	130	2.435	1,042	1,626	675	845
DEPARTMENT OF THE NAVY	10,505	18	-	523	15	6,264	3.605	80	-
DEPARTMENT OF THE AIR FORCE	34.665	10,122	4,749	347	312	14,975	1.525	1,976	659
DEFENSE AGENCIES	6.899	-	-	-	-	3,187	-	3,271	461
DEPARTMENT OF ENERGY	20,560	-	-	13,108	587	442	1,659	442	4,322
DEPT OF HLTH & HUMAN SERVICES, TOTAL	13,336	-	-	-	-	-	-	-	13,336
NATIONAL INSTITUTES OF HEALTH 1/	13,336	-	-	-	-	-	-	-	13,336
OTHER AGENCIES									
NATIONAL AERONAUTICS & SPACE ADMIN	16.770	4,925	236	145	50	2,226	2,510	474	6,204
NATIONAL SCIENCE FOUNDATION	22,754	44	-	4,653	4,688	5,607	3,412	2,633	1,715

1/ DETAILED NIH DATA FOR FY 1985, 1986, AND 1987 WERE UNAVAILABLE AT THE TIME OF PUBLICATION. FIELD OF SCIENCE/ENGINEERING, PERFORMER, AND GEOGRAPHIC DATA WERE ESTIMATED BY NSF.

NOTE: THE APPLIED RESEARCH OBLIGATIONS OF THE SIX AGENCIES INCLUDED IN THIS TABLE REPRESENT APPROXIMATELY 87 PERCENT OF TOTAL FEDERAL APPLIED RESEARCH OBLIGATIONS TO UNIVERSITIES AND COLLEGES IN FY 1986.

SOURCE: NATIONAL SCIENCE FOUNDATION

Table 6.9.C

FEDERAL OBLIGATIONS FOR RESEARCH AND DEVELOPMENT TO FOREIGN PERFORMERS AND AMOUNT SUPPORTED THROUGH THE SPECIAL FOREIGN CURRENCY PROGRAM, BY AGENCY: FISCAL YEARS 1985, 1986, AND 1987

(THOUSANDS OF DOLLARS)

AGENCY AND SUBDIVISION	ACTUAL, 1985		ESTIMATES			
			1986		1987	
	TOTAL	SPECIAL FOREIGN CURRENCY PROGRAM	TOTAL	SPECIAL FOREIGN CURRENCY PROGRAM	TOTAL	SPECIAL FOREIGN CURRENCY PROGRAM
TOTAL, ALL AGENCIES	255.893	21,766	257,808	11.452	219,795	5.152
DEPARTMENTS						
DEPARTMENT OF AGRICULTURE, TOTAL	9.646	6,263	6,272	2,983	3.718	434
AGRICULTURAL RESEARCH SERVICE	3.368	-	3.278	-	3.278	-
FOREST SERVICE	15	-	11	-	6	-
OFFICE OF INTERNATIONAL COOPERATION AND DEVELOPMENT	6.263	6.263	2,983	2.983	434	434
DEPARTMENT OF COMMERCE, TOTAL	1.473	1,371	432	387	-	-
NATIONAL BUREAU OF STANDARDS	15	-	15	-	-	-
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION	87	-	30	-	-	-
OFFICE OF THE SECRETARY	1.371	1.371	387	387	-	-
DEPARTMENT OF DEFENSE, TOTAL	91.996	5.757	106,398	3.125	79.768	2.230
DEPARTMENT OF THE ARMY	15.774	-	10,972	-	8.156	-
DEPARTMENT OF THE NAVY	59.136	5.757	76,186	3.125	49.524	2.230
DEPARTMENT OF THE AIR FORCE	11.076	-	12,273	-	15.100	-
DEFENSE AGENCIES	6.010	-	6,967	-	6.988	-
DEPARTMENT OF EDUCATION	1,700	-	150	-	150	-
DEPARTMENT OF ENERGY	1,759	-	1,316	-	670	-
DEPARTMENT OF HEALTH AND HUMAN SERVICES, TOTAL	42.589	3,762	41,123	1,913	38,321	1.463
ALCOHOL, DRUG ABUSE & MENTAL HEALTH ADMINISTRATION	829	-	785	-	788	-
CENTERS FOR DISEASE CONTROL	1.977	1.977	800	800	420	420
FOOD & DRUG ADMINISTRATION	75	-	30	-	15	-
NATIONAL INSTITUTES OF HEALTH [1]	39.030	1.297	39.295	1,075	36.917	1.012
OFFICE OF ASSISTANT SECRETARY FOR HEALTH	488	488	38	38	31	31
SOCIAL SECURITY ADMINISTRATION	190	-	175	-	150	-
DEPARTMENT OF THE INTERIOR, TOTAL	1.683	1.683	1,918	1,918	-	-
OFFICE OF THE SECRETARY	1.683	1,683	1,918	1,918	-	-
DEPARTMENT OF JUSTICE, TOTAL	41	-	-	-	-	-
OFFICE OF JUSTICE PROGRAMS	41	-	-	-	-	-
DEPARTMENT OF TRANSPORTATION, TOTAL	114	-	-	-	-	-
COAST GUARD	54	-	-	-	-	-
MARITIME ADMINISTRATION	60	-	-	-	-	-
DEPARTMENT OF THE TREASURY, TOTAL	70	-	25	-	50	-
BUREAU OF ENGRAVING AND PRINTING	70	-	25	-	50	-
OTHER AGENCIES						
AGENCY FOR INTERNATIONAL DEVELOPMENT	91,920	-	90,229	-	87,999	-
ENVIRONMENTAL PROTECTION AGENCY	804	200	825	200	350	350
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	7,367	-	7,420	-	7,420	-
NATIONAL SCIENCE FOUNDATION	3.139	2,730	1,363	926	1.184	675
NUCLEAR REGULATORY COMMISSION	1.592	-	337	-	165	-

[1] DETAILED NIH DATA FOR FY 1985, 1986, AND 1987 WERE UNAVAILABLE AT THE TIME OF PUBLICATION. FIELD OF SCIENCE/ENGINEERING, PERFORMER, AND GEOGRAPHIC DATA WERE ESTIMATED BY NSF.

SOURCE: NATIONAL SCIENCE FOUNDATION

ACS OFFICE OF STATISTICAL SERVICES PUBLICATIONS

Salaries: The Office of Statistical Services annually surveys the ACS membership, gathering detailed information on member chemists and chemical engineers. The reports based on this survey contain statistical tables describing the respondents' employment status, employer, work function and specialty, salaries, and demographic characteristics.

Reports are available for each year from 1973 through the current year. In 1987, four separate reports are available: *1987 Salaries of Non-Academic Chemists, 1987 Salaries of Non-Academic Chemical Engineers, 1987 Salaries of Academic Chemists,* and *1987 Employment Status and Demographic Characteristics of ACS Members.*

Starting Salaries: The Office of Statistical Services also surveys new graduates in chemistry and chemical engineering each summer, and publishes reports detailing the graduates' employment status, post-graduation plans, starting salaries, and other employment and demographic characteristics.

Reports are available for each year from 1975 through the current year.

Professionals in Chemistry: The *Professionals in Chemistry* series compiles information concerning chemists and chemical engineers from ACS, government, and private industry sources. It details information on demography, employment, salaries, education, and supply and demand for the entire chemical profession.

Reports are available for each year from 1975 through 1978, and combined reports for 1979-1980, 1981-82, 1983-84, and 1985-86.

Special Reports:

1975 Report of Chemists' Salaries and Employment Status Supplement: Economic Status of Women in the ACS.

Women Chemists 1980: A supplemental report on the ACS's 1980 Survey of Salaries and Employment.

Women Chemists 1985: A supplemental report on the ACS's 1985 Survey of Salaries and Employment.

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